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THE CONVENTION LAST WEEK

Niagara Falls Visited by the Advocates of Electric Light and Power, Who Hold a Highly Successful Three Days' Session.

A PARTICULARLY INTERESTING AND INSTRUCTIVE LIST OF ADDRESSES ON SUBJECTS OF PRESENT IMPORTANCE—MANY VALUABLE POINTS BROUGHT OUT IN THE DISCUSSION—VISITS TO NIAGARA'S ELECTRICAL ESTABLISHMENTS—AN ARRAY OF EXHIBITS OF SMALLER APPARATUS AND INCLOSED ARCS—SAMUEL INSULL, OF CHICAGO, ELECTED PRESIDENT—RULES FOR SAFE WIRING ADOPTED AND A COMMITTEE ON LEGISLATION TO PREVENT THEFT OF ELECTRICITY APPOINTED.

When President Frederic Nicholls tapped for order a few minutes before noon at Niagara Falls on Tuesday last, with the beautiful, engraved gold button that betokened his office and becomes his property for all time shining on his breast, there were probably upwards of 300 members in their seats facing him. Outside in the hotel corridors were as many more. These numbers increased until Wednesday noon, when it was safe to say that nearly 1,000 visitors were within the jurisdiction of the Electric City of Niagara Falls, brought there by interest in the proceedings of the twentieth convention of the National Electric Light Association, and by the effective work of President Nicholls and staff in organizing and planning for the occasion.

The convention passed off with animation, success crowning each day's work, and the usual little political bout at the end over the new officers resulted in bringing to the work for the ensuing year some of the younger men, and the members were pleased. There was no wrangling, which was the conspicuous feature of the convention in Niagara Falls eight years ago, and the presiding officer's emblem of authority was only a neat, small mallet, not the historic piece of stage lumber that splintered the table on the former occasion.

In this journal, two weeks ago, was printed a view of a large party of members of the association photographed in New York nine years ago; in this issue is presented a reproduction of the group photographed on Wednesday of last week immediately after the noon adjournment of the convention. These two groups represent much that is of interest in the *personnel* of the association, and a comparison will find many new and young faces in the latter group, while in the first will be seen many countenances of one-time active electric light men who are not to be found here.

The general opinion among the delegates was that the convention was as important and instructive as any previous one, and in some respects, particularly in the quiet determination to secure full and expert information from the speakers and essayists, it surpassed all former meetings. The exhibits, while not filling a hall as often before, were attractive and representative of modern work.

The next convention will probably be held in the West, the decision as to location resting with the executive committee.

At Niagara Falls.—View of the Electric Light Visitors, Photographed at the International Hotel, Wednesday June, 9, 1897.

TUESDAY, JUNE 8.

The twentieth convention of the National Electric Light Association met at the International Hotel, Niagara Falls, N. Y., June 8.

MORNING SESSION.

President Frederic Nicholls called the meeting to order at 10.45 A. M., and invited the vice-presidents and

ex-presidents of the association to the platform.

The president read letters of invitation from the following: From the Niagara Falls Power Company; Niagara Falls Hydraulic Power and Manufacturing Company; Buffalo & Niagara Falls Electric Light and Power Company; the Carborundum Company; the American Telephone and Telegraph Company; from Mr. B. E. Green, rental agent, Grand Central Palace, New York. Also letters of regret from the following: Prof. Edward L. Nichols, of Cornell University; Sir William Dawson, Magill University, Montreal; Prof. Henry T. Bovee, Montreal, and Lord Kelvin.

The president then read his address, as follows:

PRESIDENT NICHOLLS'S ADDRESS.

MEMBERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION: In arriving at a decision as to the most suitable place at which to hold the twentieth convention of the National Electric Light Association, the executive committee and your president were guided largely by the desire to select a spot where our members could have some practical illustration of the most recent advances in electrical development as applied to every-day commercial use on an extended scale.

Niagara Falls, N. Y., appeared to offer superlative inducements as our place of meeting, judged by this standard, and was accordingly given the preference; and with a knowledge of the programme that has been prepared for the instruction of our members, and the many interesting features for the entertainment of themselves and their friends, I am confident that before the close of the convention, those present will unanimously be of the opinion that our choice was wisely made.

When we consider that only five years since many of us were in attendance at the fifteenth convention of the association held in Buffalo, and were listening to the discussion which followed Dr. Carl Hering's paper on "Transmission of Power," even the most sanguine of us but little imagined that in half a decade we should be holding our twentieth convention at Niagara Falls, principally with the object of seeing and realizing the actual application of motive power derived from the Falls, to some of the most novel and most important industries of the country.

To "harness Niagara" had long been a dream, but is now an actuality, and who can foretell the resultant progress and advancement that we may be destined to celebrate within the next few years.

There is no parallel in history for such rapid development of any industry as that of the manufacture of electrical apparatus and its application, or to be strictly correct and quote ex-president of the association Mr. M. J. Francisco, who is an authority on the subject, the only parallel was when the world was created in six days out of nothing. Five years ago we were discussing the possibilities of transmitting power in small units to moderate distances; to-day the problem is solved and innumerable installations are transmitting power in large quantities for long distances, and yet we have only crossed the threshold.

In this connection, I am of the opinion that the lecture to be given to-morrow evening by Mr. L. B. Stilwell will serve as a tidal mark. At the Buffalo convention we occupied ourselves in discussing the possibility or otherwise of transmitting Niagara power to Buffalo; Mr. Stilwell's paper will set forth the various actual applications of Niagara power at the present time, including transmission to Buffalo, and future presidents of this association will, in all probability, refer to his paper and draw comparisons when adverting to the strides which will by then have been made in the wider utilization of this mighty power, which for countless ages has been simply running to waste so far as any economic use is concerned and apart from its value as the greatest scenic wonder of the world.

I fully appreciate the honor of presiding at this meeting which, for the reasons I have just referred to, will be embodied in the annals of the association as marking an historic epoch in the advancement of the science of electricity as applied to industry, and it is, therefore, with more than ordinary satisfaction that I am authorized to state that at no previous period has this association been as prosperous, shown greater vitality or commanded such respect. It is now an acknowledged authority on matters electrical, its membership confers a privilege that has more than a sentimental value, and its gathering strength will offer a bar to use of powers, municipal or corporate, unjustly or arbitrarily directed for the purpose of destroying the capital investment of those who look to it for protection.

In union is strength, and to-day our membership numbers more active members than ever before, and the financial statement, to be presented in due course by the chairman of the finance committee, will show that after making provision for all expenditures necessary to maintain the usefulness of the association, an unusually large credit balance is at your disposal.

It is certainly cause for congratulation, that increasing prosperity has been followed by an access of dignity and influence, and the more recent meetings have been remarkable for the greater interest that has been taken in the actual work of the association and the lesser attention that has been given to the merely social and entertainment features of the programme.

The desire to make the twentieth convention notably a business meeting has so far predominated that we have neither asked nor accepted any favors other than from the electric power companies and several of the manufacturing establishments using electric power for the operation of their works.

Although several delightful and interesting excursions have been arranged for, the association has made, on behalf of its members, a businesslike arrangement for the several trips and excursions set forth in the programme of the convention, preferring to pay our way rather than tax the courtesy of the transportation and other companies by accepting dead-head privileges. In view of the fact that I have had occasion to communicate with our members, from time to time, during the past year by the issuance of printed "Interim Reports" referring to the work undertaken by your executive, it is unnecessary to give an account of my stewardship in this address, but I may say that many matters of urgent importance are pressing for settlement, and which will doubtless receive the most careful attention at your hands during the next few days.

The list of papers to be read at this convention is an exceptionally good one, and the authors are of more than continental reputation, and I therefore trust that our members will show their appreciation of the care and study given to the preparation of these papers, by being present in force at every session, and taking an active part in the discussion that will ensue.

Notwithstanding the progress that has been made in the perfection of apparatus and the application of new principles, there never was a time when there was more to learn than now, and no more fitting occasion is likely to present itself to us to familiarize ourselves with the latest procedure in our chosen profession, and the papers to be read and the discussions thereon will find hundreds of thousands of readers and students, thanks to the electrical journals of which we are all justly proud.

No other art, science, industry or profession has been so well and faithfully served by an enlightened and progressive technical press as our own, and who can estimate the fair share of credit justly their due for the part they have taken in aiding and advancing the introduction of electro-motive force in its many and varied applications.

As we have a lengthy programme before us and several important reports of committees to receive and discuss before we adjourn for mid-day recess, I now declare the twentieth convention of the National Electric Light Association open and ready for the transaction of business.

The President: This morning's session, as is usual with the opening session of the convention, will be necessarily short, and we will take up the usual reports of committees in their regular order. The first order on the programme is the report of the Committee on Standard Candlepower of Incandescent Lamps, by Dr. Louis Bell, chairman. I might say in this connection that a very great deal of work has been done since the last meeting of the association in New York toward this end. Very few of you know the amount of work and the amount of correspondence that has taken place between the chairman, Dr. Bell, and Mr. James I. Ayer, our past president, who has taken a great interest in the subject, and I think that this question is more nearly approaching a solution than ever before. I never felt in my whole experience the utter hopelessness of fighting against time as I have this year in trying to get so many matters absolutely concluded during my administration. Some of them have been happily carried to a successful conclusion. Others are so far advanced that I think my successor will have no difficulty in bringing them to such a point that before the next convention will meet many of these important questions of standardization will have been applied to a good many of the leading articles of the electrical business. I will call upon Mr. Ayer as one of the committee.

Mr. Ayer: Dr. Bell at the last moment telegraphed that he would be unable to come to Niagara, and had furnished me with a rough draft of a report. In fact we sat up nearly all night engaged in getting the report into shape. I have only a pencil draft of it, not suitable to be read and I would ask that the matter be laid over until to-morrow to give us an opportunity to have the report prepared for presentation.

The President: The next report is that of the Committee on Data, Mr. H. M. Swetland, chairman.

Mr. Swetland read his report and received a vote of thanks, and the committee was discharged.

Mr. Seely then made his financial report.

The President: I am sure, gentlemen, that you must all be satisfied with the present showing of the finances of the association. We have absolutely no liabilities. We have surplus assets amounting to over $2,500.

Mr. Seely: I desire to give notice to the chair that I shall move to change the by-laws to the effect that the retiring presidents shall all become honorary members of the association.

The President: I will let that stand as a notice of motion.

The convention took a recess until 2.30 P. M.

FIRST DAY—AFTERNOON SESSION.

The President: There is considerable business to be done this afternoon. I also have to announce that after the close of this afternoon session we intend to proceed to inspect the power-house of the Niagara Falls Power Company.

A communication from a gas engine company was, on motion, laid on the table.

Professor Owen, of Nebraska, spoke in favor of Omaha as the next meeting place, and Mr. Evans Woollen eloquently advocated Indianapolis.

The President: It is moved and seconded that the invitations be referred to the Executive Committee, as usual, to be acted upon. Is it your pleasure that that motion carry? Carried.

The President: I might say here that a photograph of the delegates will be taken immediately after the close of the session to-morrow morning. Invitations to Mr. Stillwell's lecture to be held in the Park Pavilion to-morrow evening can be had upon application to the secretary. I would also ask all those who have not yet registered to kindly do so. Mr. Cahoon, of Elmira, then read his paper on "Standardizing Prices for Incandescent Light and Power," and received a vote of thanks.

The President: The next item upon the programme is the topic for discussion entitled, "Theft of Current and How to Deal With It." During the past year when I have been looking into several matters and considering lines, or directions, in which work could be done that would serve the best interests of the members of the association, I was very much astonished to find that in hardly any State of the Union was there provision made in the common law for the punishment of any person who would deliberately steal current from the street mains or otherwise. It seems to me that that is something that should be provided for. I know in Canada we have provisions made for the punishment of theft of current.

Mr. T. C. Martin: I mentioned this morning that I believed I had copies with me of the bill which has just been passed by the State of Connecticut penalizing the theft of current. The bill was passed at the last session of the Connecticut Legislature. There was a small money fine attached to the offense, or a short term of imprisonment, quite short. The bill seemed to me at that time weak in regard to the requirements as to the proof of theft.

Mr. Ayer: I think the time is opportune for the association to take action in this direction, and we have some little legal talent connected with the association, and I would suggest that a committee be appointed with a view of composing that committee of lawyers for the purpose of drafting suitable legislation, or for outlining the points to be covered, for statutes in the different States.

Mr. A. M. Young, of Waterbury: In relation to the law that has just now been passed in Connecticut, it happened to be a duty of my own, as treasurer of the Connecticut Electric Lighting Association, to have this particular bill drafted, and it was drafted by the attorney for our association, and it passed without any serious opposition through the legislature of our State, and has been signed by the governor. The penalty attached is a fine of $50 or imprisonment for 30 days, or both. We found it very necessary to have a law of that sort passed in our State, and we took active measures and successful measures to have it done.

Mr. Stetson: If it is thought well to appoint this committee I might say it would be well to examine the law that is in force in Massachusetts. Last year, or the year before, the law was made to apply to the theft of current the same as to the theft of gas; and it gives me pleasure to report the case of a man who ordered out his meter and put in wire to occupy the space that the meter previously occupied and had gone right on in the lighting business. I put the matter into the hands of the Circuit Court of our city. The judge heard the case, and it cost the man $55 to get about 50 cents worth of electricity. A singular thing about this case was that the man that drew the law was the counsel of the man that stole the electricity; and he came up with some very learned legal points, arguing that the whole indictment ought to be quashed and something that I didn't know anything about; but our judge sat down very squarely on all that and landed the man just where we wanted he should be; and the moral effect on our community has been very good. I should advise a study of that law.

Mr. Barker: I do not think I can

add anything to what Mr. Stetson has said. The law, I think, was promoted by the efforts of the Massachusetts Electric Lighting Association. It was passed by the legislature with practically no opposition, and, perhaps, the passage of the law was aided by the fact that a law prohibiting such theft of gas had been upon the statute books for a number of years. I think the courts in our State have held that it is not a common law offense to purloin gas, and, therefore, they would be likely to hold in the same way with respect to electric current; but the statute seems to be a sound one. I think there have been a number of prosecutions successfully carried out under it in our State—if I mistake not, in the city of Lynn. It has been in existence for a couple of years, and is modeled after the act which prohibits and punishes the theft of gas, and I think the general opinion is that it is a good law.

Mr. Martin: Mr. Stetson's suggestion moves me to believe that perhaps it would be a good thing if I could supply the omission of bringing the bill with me by placing it in the hands of the official stenographer. That would make it a part of the transactions.

The President: We will be very pleased to have the draft of the bill.

Mr. Martin: Cases of theft seem to be getting daily more numerous, and now that we are threatened with the application of it in large quantities for the purpose of burglarizing safes, it seems to me perhaps it would be well to protect ourselves before that new industry gets upon its feet. [Laughter.]

W. P. Engel, of Charlotte, Mich.: With your permission, and that of the members, as I am not a member of this association, I would say that legislation has been inaugurated in the State of Michigan, upon this subject, through the efforts of several central station men and the Municipal Light and Power Company, of Grand Rapids, sent out a circular which embodies a law called House Bill No. 955, legislative session of 1897. That law embodies punishments, and it also includes gas, water and electric current. I have a copy of it, and if a committee is appointed I will deliver this to them.

Mr. Beggs: I have been instrumental in having one conviction brought about in the city of Cincinnati, although the Ohio law is somewhat indefinite upon the point. We could only proceed under the law that was passed for tapping wires, for an entirely different purpose. In this case we prosecuted the man, and, I believe, he was subjected to a fine of $50. But our greatest difficulty was to have the grand jury even bring in a bill against him, because of his political pull. He was a prominent saloonkeeper, and if we had not had a stronger political pull even than he had through our counsel we could not have convicted him at all. It required very peremptory orders sent four or five times to the District Attorney to have the case presented to the grand jury, and I think it stayed there for several months. But it was a saloon in which we never even had furnished the current. He had been cut off for non-payment of bills by one of our competitors. Our lines happened to cross near the rear end of his premises. He threw out a grappling hook and got connection on there, and lighted himself for several months in that way. There was really no law in the State of Ohio, except we prosecuted him upon the charge of tapping wires, under a law that was passed for the protection of race courses and things of that kind.

Mr. Clay: I believe, Mr. President, the motion is to refer this matter to a committee. I fail to see how any such committee would accomplish any satisfactory results to the members of this association. Two years ago we put upon the statutes of Pennsylvania a law which makes it a misdemeanor, punishable on conviction by fine and imprisonment, for any person to take current or in any way interfere with electrical apparatus. The thought has occurred to me that we could best accomplish the end that we have in view if the secretary would request the delegates here from the States that have satisfactory laws upon this subject to send copies thereof to him and have all these

FIG. 1.—EXHIBITS AT THE NIAGARA FALLS CONVENTION—DIAMOND ELECTRIC, H. M. UNDERWOOD & COMPANY.

various statutes printed in the proceedings of this convention as an appendix or an addenda for reference and for information; and in that manner the members of any State that has no such law, if they desired to make an effort to have one enacted, could have what has already been done in other States as a guide.

Judge Armstrong: From what has been said in relation to the various laws that have been passed I judge that the penalty is grossly inadequate. You know there is an old adage, where there are 12 lawyers there are 13 opinions always. But I am strongly under the impression that if a grand jury should return a bill of indictment for larceny to my court against a man for tapping a wire and taking power, and the jury believed that he had done it, I should not hesitate to sentence him for larceny under the law as it now stands. There is nothing in our State that I recall, no decision of the Supreme Court, that would prevent that thing. This Michigan proposed bill, and the one in Connecticut, makes it a slight misdemeanor only. If a man steals about $30, I think it is, it is grand larceny and he may be imprisoned for from two to five years, depending on the circumstances. Here, three months and $100 is the maximum penalty in this bill. In the Connecticut bill it was $50. We can with propriety, if it is thought advisable, recommend legislation to prevent frauds as against these companies, the same as they have to prevent frauds against railroad companies in some places, you know, in the sale of tickets by scalpers. I believe, however, the title of those acts always is "to prevent frauds against travelers." I believe that is the way it reads in the title of the acts. So that we might have to borrow from that suggestion and make the title of our act read that way. But what I want to do is to protest as strongly as I can to this association against their recognizing by anything they do the propriety, if I may say so, of anybody taking electric current the same as they would take in sunlight or take in air.

The motion to appoint a committee of three was carried.

Capt. Wm. Brophy, as chairman of the committee, presented his report on "Rules for Safe Wiring." His rules were unanimously adopted:

TO THE PRESIDENT AND MEMBERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION: At the seventeenth convention of this association held in New York city, a committee to be known as a Committee on Standard Electric Rules, consisting of five members, was appointed, with instructions to select one of its members or some other person to represent the National Electric Light Association in the National Conference on Standard Electric Rules.

This committee was the successor of the one that was appointed at the fourteenth convention of this association, known as the Committee on Safe Wiring, and subsequently known as the Committee on Standard Rules for Electrical Construction and Operation, which was discharged on its own recommendation at the same time. This last named committee has labored faithfully since its organization to bring about the much desired end—the establishment of a uniform standard set of electrical rules governing all electrical installations, to be enforced by the fire insurance companies and municipal inspection bureaus. This task was no easy one for this committee. Its efforts met with fierce opposition from some and indifference on the part of others. It received some encouragement from the press at times, and no small amount of opposition at others. Some portions of the insurance interests looked upon it with favor, but a large portion opposed its aims and purposes. The principal obstacles to be overcome were:

First, indifference on the part of those most deeply interested—those engaged in the electrical industries. They somehow believed that the fire underwriters of the company were more powerful than the municipal, State, or even the United States Government; that any law, edict or rule issued by them, whether right or wrong, could be enforced and must be obeyed. For the benefit of this class, your committee must say that such is not the case. The fire underwriters are receiving and disbursing agents of nearly the whole of the people of the country, receiving their money as a consideration for indemnity against

FIG. 2.—ELECTRIC FAN EXHIBIT OF WESTERN ELECTRIC COMPANY.

total loss by fire. The larger proportion of the money they receive is returned as partial compensation for the losses sustained, the balance pays the expense of the business and a varying amount of profit to the holders of stock, and the policy-holders of mutual insurance companies. The greater the care in selecting fire risks and the more careful the supervision of them while insured, the greater the profit.

The next obstacle to overcome was the prejudice of the average underwriter against electricity when introduced into the property he insured. To those who witnessed the methods adopted by those who installed the first electric light and know something of the losses sustained by the insurers and insured, this prejudice is excusable. Up to that time electricity had proven itself a useful and harmless servant, the only evidence of its ability to produce heat or flame was offered at the contact points of the telegraph relay and key, but when this very small spark was increased at the carbon points to such size and intensity as to rival in brilliancy the sun's rays, its power for good and evil was wonderfully increased. Those who could keep under perfect control the feeble battery current, did not possess the necessary appliances or knowledge to keep this new form of electrical energy under proper restraint, while the fire underwriters paid heavy tribute to it in the form of burnt offerings and in the shape of indemnity to the policy-holders.

Under such circumstances, who could blame these powerful bodies for taking alarm, and look upon the new candidate for public approval with disfavor? They were between two fires as it were, those caused by electricity improperly harnessed, and that of enthusiastic admiration kindled in the breasts of their policy-holders for the electric light; they would have it even if it did increase the fire hazard. How to get out of this dilemma was the burning question; they did not want to abandon a formerly profitable part of their business, but feared they must. Two remedies were tried: First, increased insurance rates was the penalty exacted for the introduction of electric lights. This plan proved ineffectual, because it did not prevent losses in excess of premium rates, and it opened up a new field for the illegitimate underwriter who preys on the insurer and insured alike in the end. The second remedy proved more effective. They called to their aid some of those who were supposed to know how to lead this new and unknown force along the straight and narrow path designed for it and not permit it to wander into their domain and change fat dividends to heavy assessments. Such men were scarce, and most, if not all of those engaged, were obliged to learn by experience the best methods of procedure; the same can be said of those engaged in the electric business, the acquisition of such experience up to a few years ago proved very costly to the fire underwriters and others as well.

FIG. 3.—VIEW OF THE EXHIBITS OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY AND THE SAWYER-MAN COMPANY.

Gradually, fire insurance associations appointed one or more inspectors to examine the electric light wires, lamps and fixtures installed in their territory, and enforce certain rules and requirements generally made by themselves. With the rapid advance of the electrical industries changes in these were inevitable, but lack of uniformity proved to be a crying evil. The best and most reasonable requirements were formulated in the sections of the country where the electric light had found a foothold earliest. Most of the inspectors, instead of profiting by the experience of those longest in the business and adopting the rules formulated by them, insisted on issuing productions of their own, so that the so called insurance rules differed as widely as the excise laws of Maine and New York. Some sections of the country were fortunate enough to have men who were empowered to make rules and enforce them, whose elevation to such position did not make them dizzy and cause them to issue impractical requirements, the enforcement of which did not always serve any good purpose, but made life a burden to those who were so fortunate as to come under their jurisdiction, whether manufacturers, contractors or producers of electrical energy. But other sections were not so fortunate. Among all the burdens that those in the electrical business have had to bear in the past, the whims and caprices of the authors of insurance rules were not the least.

The loss of time and money, caused by conflicting requirements, became so great in time a movement was inaugurated by this association for securing uniformity of rules—a codification of the best and repeal of the productions of cranks and impracticals.

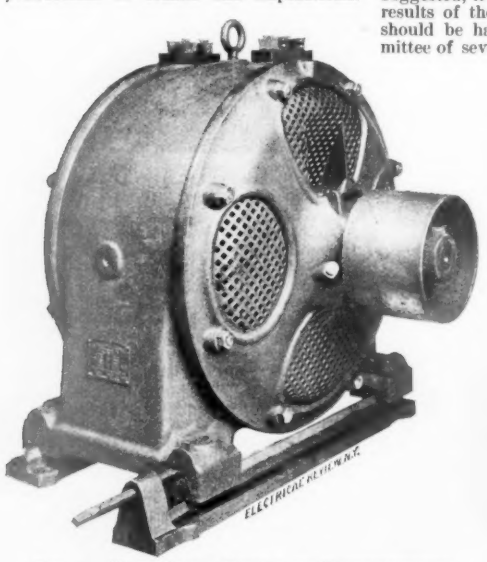

Fig. 4.—New Motor Shown in Westinghouse Exhibit.

Fig. 5.—Exhibits of Partrick & Carter and L. A. Chase & Company.

Fig. 6.—Exhibit of the Hope Electric Appliance Company.

This task was accomplished by your former committee, the results of their labors approved and the first national code issued by this association. It was also adopted by the insurance associations, who thus recognized the good work performed. After the issue of this national code, it was thought that all the troubles here described were ended. Such, however, was not the case, for, while the best representative men of the fire insurance associations agreed that the electrical engineer or electric light superintendents were the proper ones to formulate the rules and requirements and the insurance associations should enforce them, there were others holding subordinate positions who could not bear to have this sentiment put in practice. As a result of such feeling an organization, known as "The Underwriters' National Electric Association," has claimed the sole right to issue new or amend the original rules first issued by this association, and has in the past insisted that the electric and allied interest should have no voice therein. As time rolled by and the organization increased in numbers, this sentiment has changed somewhat, due to the influence of broad-minded, practical men who are members of it, and to the efforts of your former and present committees, and last, but not least, to those of the National Conference on Standard Electrical Rules, which was organized through the untiring efforts of the chairman of the committee on standard rules for electrical construction and operation, Mr. W. J. Hammer and his associates.

As a result of our combined efforts, the last codification of and amendments to the national code are the result of the combined efforts of the National Conference on Standard Electric Rules and the Underwriters' National Electric Association. The right to do this is what your committees have contended for in the past and have finally obtained. Your present committee on standard electric rules selected its chairman to represent you in the National Conference on Standard Electrical Rules, which was organized at a meeting held in the city of New York on March 18 and 19, 1896, of representatives of insurance, electrical and kindred interests, consisting of the following organizations:

National Electric Light Association, American Institute of Electrical Engineers, American Street Railway Association, National Board of Fire Underwriters, American Institute of Architects, International Association of Fire Engineers, Underwriters' National Electric Association, Factory Mutual Insurance Association, American Society of Mechanical Engineers, Western Union Telegraph Company, Postal Telegraph Company, American Bell Telephone Company, General Electric Company, Westinghouse Electric Company. The complete list of official delegates, complimentary delegates and organizations to whom invitations were extended can be found in the report of the committee presented at the last convention and published in the last volume of this association's proceedings. That body appointed a Committee on Code, consisting of seven members, one of whom was your representative; to this committee was assigned the task of amending and codifying standard electrical rules. At the time of the last meeting of the National Conference upon Standard Electrical Rules, a large amount of work was done by representatives of the various electrical, insurance, architectural and allied interests, tending toward the adoption of the one single standard code of rules. A pamphlet had been prepared embracing the various codes used most extensively in this country and abroad; and after these had been in substance considered, and many changes, omissions and additions suggested, it was deemed desirable that the results of the two days' careful discussion should be handed over to a special committee of seven, with the president a member *ex-officio*, which committee should draft a code based upon the lines suggested, and then refer the same back to the conference for its approval.

Since the meeting of the conference the committee has, by meetings and correspondence, carefully taken up the work assigned to it. The most important meetings were held October 16 and 17, 1896, and December 11 and 12, 1896. Between these two dates, i. e., December 8 and 9, the annual meeting of the Underwriters' National Electric Association was held, and at the October meeting of the Code Committee it was decided that the committee, through one of its members, Mr. Merrill, should submit the draft, already prepared by them, to the Underwriters' National Electric Association, to secure the benefit of their criticisms and suggestions, and with a view of insuring a hearty co-operation upon their part. It was arranged that a joint meeting should be held of our committee of the code and a committee from their association to facilitate the preparation of the final draft of the code. This meeting, held in December, 1896, was very successful, and it was jointly agreed by the two committees that the title of the new set of rules was to be: 1. "The National Electrical Code." 2. "That the National Board of the Fire Underwriters, in printing the code, would give, on the inside of the cover, due credit to the National Conference for its work, and place upon the cover the names of all the associations forming the National Conference as fast as these bodies give their indorsements of the code." 3. "That as far as possible the code should be left in the form as then presented, save that the classification, as recommended by Mr. French, be tentatively adopted, and after being set up by the printer be re-submitted in 'dummy' form for final consideration by the members of both committees." The members of the Code Committee of the National Conference having met in New York, May 19, 1897, passed the following resolutions:

Resolved, That each delegate who attended the National Conference on Standard Electrical Rules, be sent a copy of the Standard Electrical Code, stating that said code had met with the approval of the Code Committee of the National Conference and the Code Committee of the Underwriters' National Electric Association, and stating the belief of our committee that there was no necessity for calling the conference together as a body again, entailing, as it would, a very considerable sacrifice of time and money, and requesting their immediate reply if they acquiesce in this recommendation and approve of the report submitted by the committee, and by the president, secretary and treasurer of the conference itself. In the event of their objecting and desiring that the conference as a body be called together as a body to receive the committee's report, answer is to be made within 10 days or their opinion is to be considered as favorable and the code and reports published through the press by the Code Committee, and each delegate represented at the conference requested to bring same formally before his association for approval. A meeting of the committee was held in Boston on the 5th instant, at which its previous action was ratified and the code as a whole unanimously adopted. The National Electric Light Association was the first to adopt and issue a national standard code of rules, and if it now adopts the new codification of them it will not only be indorsing the unanimous findings of its committee, but the unanimous action of the Code Committee of the National Conference on Electrical Rules, which conference was organized under the auspices of the association; but, furthermore, it will be the first body represented in the National Conference to do so, and your committee earnestly recommends that it gives its approval.

Respectfully submitted.

In response to inquiries as to the scope and weight of these rules, Captain Brophy said: "Hereafter you can hold up this code as the one you are called upon to work under and nothing else." (Applause.) The rules were adopted by a standing vote.

W. Worth Bean then read his paper on "Municipal Lighting." A vote of thanks was extended to Mr. Bean.

His paper is published on another page.

Mr. Dougherty: I consider this subject a very, very serious one. I think it is a matter that would warrant the attention of this association. I have had a little experience in that as former chairman of the Northwestern Electric Association. The city plants now in operation are, many of them, a dismal failure, but every one of them sends out reports that look very inviting to other cities.

Mr. Beggs: It seems to me that there is no use to which the association could devote a part of those surplus funds with greater advantage to the central station and lighting interests of the country than to employ an intelligent, pains-taking expert to get reliable data from a number of municipal plants in different sections of the country. As has been well stated in this paper, the data that is available, except in very few cases, is unreliable in the extreme. We are doing what we can do in a legitimate way to render unnecessary the exploitation of municipal plants by municipalities over the country; and therefore we should see how we can reduce the cost of producing electric current to such a price as that we can show to a city that we can supply current because of the large business that we are doing. Mr. President, I have to suggest, and I make it as a motion, that, before we get through, the Executive Committee of the association send an expert paid by this association to get those figures. Let us know the facts. It is high time we had them.

The President: Do you suggest an expert accountant, an expert electrician, or what kind of an expert?

Mr. Beggs: Either one. We must have a man that knows enough about the expert side of it, and likewise the commercial side of it to get those figures.

The President: Mr. Beggs, Judge Armstrong suggests that that motion come before our Executive Committee, which will be convened in a few minutes.

The chair appointed Mr. Ayer, as the mover, Judge Armstrong and Senator Foster S. Voorhees, of Elizabeth, as members of the committee to draft a law providing for the punishment of the theft of electric current.

An invitation for Fortress Monroe, as the next meeting place, was read and referred to the Executive Committee. It was from Mr. Geo. W. Sweet, of the Hotel Chamberlain.

Adjourned after announcement of a proposed visit to the power-house of the Niagara Falls Power Company.

SECOND DAY.

MORNING SESSION.

President Nicholls announced the placing at the service of delegates of the long-distance telephone lines at any time between nine in the evening and nine in the morning, without charge; the association button being a sufficient introduction at the telephone office.

The President: I have much pleasure in calling upon Mr. J. G. White, of the White-Crosby Company, New York, to read a paper on "The Niagara Power Transmission Line." This has been a subject of great interest to all of us, the construction and maintenance of lines for the transmission of electricity at high tension, and I am sure that this particular paper will be one of great interest to every member of the association.

Mr. White read his paper. After

discussion, which, with paper, will appear in full later, a vote of thanks was tendered Mr. White.

Mr. Arthur Wright, president of the Electrical Supply Company, of Brighton, Eng., then read his paper on "Profitable Extensions of Electricity Supply Stations," which caused extended discussion.

The president announced an invitation for General Manager Littell, of the Buffalo Railway Company, asking the delegates to visit his powerhouse in Buffalo. An invitation to visit the Carborundum works was also accepted.

Adjourned to 2.30.

AFTERNOON SESSION.

President Nicholls called the meeting to order at 3 P. M., and read a letter from W. Caryl Ely, president of the Buffalo & Niagara Falls Electric Railway, inviting delegates to an excursion, special cars, from Niagara Falls to Tonawanda and return. Accepted.

There was further discussion of Mr. Wright's paper, read in the forenoon by Mr. Reason, of England.

The President: The next order of business is a paper by Prof. Charles A. Carus-Wilson, of McGill University, Montreal, entitled, "The Induction Factor; a Basis of Dynamo Calculation and Classification." I have much pleasure in calling on Prof. Charles A. Carus-Wilson.

Professor Wilson read his paper and concluded as follows: I am very much obliged to the General Electric Company for having given me this data. It is quite impossible without the aid of a blackboard and more time than we have to give to the subject this afternoon to look into the matter in any greater detail. But those of you who have this paper, who care to, will like to go into the matter more, at leisure; and if at any time you care to correspond with me on the matter at McGill University, Montreal, I shall be very glad for any data you may have to give me and to have some interchange of correspondence on the subject. [Applause.]

Vice-President Clay: I understand, Mr. President, a discussion of this paper can not be gone into without certain equations, and, therefore, I would move you that a vote of thanks be extended to Professor Carus-Wilson for the preparation and reading of this paper.

The President: It has been moved and seconded that a vote of thanks be tendered Professor Carus-Wilson for the preparation of the paper that he has just read. It is difficult for us to appreciate the amount of time and attention that must be given to the preparation of such a paper to be presented at a convention; and those of us who were at the Montreal convention, and had the pleasure of accepting the hospitality of the McGill University authorities and visited their different technical laboratories and saw the extent of the work that they had in hand in advancing the educational interests that they have under their charge, can fully appreciate how busy a man Professor Carus-Wilson is, and under those circumstances I think he is certainly entitled to a very hearty vote of thanks for the time and trouble that he has given to the preparation of this paper. I will put the resolution. Carried.

The President: It is now my more than ordinary pleasure to introduce to you a very old friend; one who has stood by the association for many years and whom we have always felt that we can call upon, no matter what his other interests might be, to be present, and not only prepare a paper when asked to do so, but who has always taken a very active part in our discussions. I call upon Prof. Elihu Thomson to read his paper on "Recent Progress in Arc Lighting."

Professor Thomson then read his paper. It appears in this issue.

A member: I move that the paper be accepted, and that the association return a vote of thanks to Professor Thomson for his able paper. Carried.

FIG. 7.—VIEW OF ONE CORNER OF THE GENERAL ELECTRIC COMPANY'S EXHIBIT.

The President: The next item on the programme is a paper by Mr. T. Commerford Martin, on "The Daylight Work of Central Stations."

Mr. Martin: My understanding of the printing of a paper is that it is for the suppression of amateur elocutionary efforts, and as my paper is in type I do not think it is at all necessary that I should inflict it upon you by slowly and laboriously wading through its successive pages. If there is any question that any gentleman wishes to bring up in connection with my remarks in the paper, or any criticism that any one wishes to make, I shall be very glad to give attention to it. Otherwise, I think, perhaps, we have more important and interesting matters outside.

The President: In other words, Mr. Martin, you suggest that your paper be read by title?

Mr. L. B. Marks: Would it be in order to take up the discussion of Mr. Martin's paper, and also the discussion of Prof. Elihu Thomson's very able paper, to-morrow morning? I would like to say a few words in relation to Professor Thomson's paper, and I know that the association wants to get out now; but I think, perhaps, to-morrow morning we will have a little time.

The President: We will certainly afford time for discussion, if it is at all possible to do so.

Mr. Insull: I move that the thanks of the association be tendered Mr. Martin for the presentation of his paper, and that any discussion be postponed until after the papers are read to-morrow morning. I say "after," because I know that Mr. Martin has an engagement in the morning, and he may be able to get here by 11 o'clock. Carried.

Adjourned to 10.30 A. M., Thursday.

THIRD DAY.

MORNING SESSION.

President Nicholls called the meeting to order at 10.30 A. M., and introduced Mr. B. F. Lamme, of Pittsburgh, Pa., who read his paper on "Polyphase Motors."

The President: I am sure we are all very much obliged to Mr. Lamme for the paper that he has prepared and read this morning. I am very sorry that we will not be able at this morning's session to give it the necessary time that it deserves for discussion. As you are all aware, we have not yet had an executive session.

AFTERNOON SESSION.

President Nicholls called the meeting to order at 2.30 P. M.

The President: I have much pleasure in calling upon Lieut. F. Jarvis Patten, of New York, to read his paper on "Frequency Transformation." The paper was read.

Mr. Chas. F. Scott, of Pittsburgh, then read his paper on "Rotaries for Transforming Alternating Into Direct Current." A vote of thanks was given Mr. Scott.

The next item called on the programme was the deferred report of the committee on standard candlepower of incandescent lamps, Dr. Louis Bell, chairman.

Mr. Ayer: In the absence of Dr. Bell as chairman of the committee, I will read the report.

Report was read and adopted, and committee continued.

Mr. Seely: I move that the secretary be instructed to prepare a set of resolutions for the retiring president, as is customary in our association.

Mr. Wilderming: I second the motion. Carried, Mr. Ayer taking the chair.

President Nicholls: Is there any other business to come before the regular convention?

Mr. Insull: I am under the impression that the record does not show a vote of thanks to Mr. White for his paper yesterday. It may be that I was not paying particular attention when it passed, but that is my impression.

The President: I am under the impression that it was passed. A vote of thanks will be inscribed on the minutes.

FIG. 8.—SWITCHES AND CIRCUIT BREAKERS OF THE CUTTER COMPANY.

Mr. Ayer: May I call attention to the matter of freight classification? The freight classification on electrical merchandise is all out of reason; that is to say, there is no discrimination. You can ship a dynamo frame with no wire on it, just a simple piece of casting, and you have to pay on it as electrical merchandise at double first-class classification. Where plants were installed, it was very common for the manufacturer to sell the goods installed. I still think we pay the freight. We are the buyers, and certainly we are all interested, all central station men are, and other purchasers, as well as the manufacturers of merchandise, in having equitable rates made, in having electrical goods properly classified. They put all classes now under the highest class. I would suggest the appointment of a committee to take this matter up with the chairman of the Traffic Association, with a view of revising the freight rates. It is a pertinent thing, I think, for this association to do.

The President: I would suggest that Mr. Ayer add this to his resolution—a special committee to be appointed by the incoming president to take up the question of amendments to the freight classification on electrical apparatus and goods. Is it your pleasure that the motion carry? Carried.

The President: Before we adjourn definitely, there is one matter that I want to bring before the members of the association. I want to refer to

(Continued on page 290.)

FIG. 9.—UNIQUE EXHIBIT OF THE PARAGON FANS.

FIG. 10.—VIEW OF THE ARC LAMPS OF THE JANDUS COMPANY AND WAGNER MOTOR—A VERY INTERESTING EXHIBIT.

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Every new theater built, or old one renovated, shows improvement in the details of stage electric lighting, the result being greater conveniences at the switchboard, or more variety in effects of illumination, or more delicate control of intensity of light and blends of color. In every way, the electric lamp has been a boon to both proprietors and stage managers. Fire danger from the source of light has been practically eliminated, and people feel safer and more comfortable in their enjoyment of the play.

THE CONVENTION AT NIAGARA FALLS.

The twentieth annual meeting of the National Electric Light Association, held last week at Niagara Falls, was an unusually successful one. A very large attendance, both of active members and representatives of the allied interests, was noticeable, and all seemed to be imbued with an unusual amount of energy, contributing greatly to the dash and vigor which characterized the meeting. Everybody was pleased with the harmony and success of the programme. Many carefully prepared and valuable papers were read, and received with close attention.

The paper on "Recent Progress in Arc Lighting," by Elihu Thomson, was a clear exposition of the onward march of the arc system during the past 20 years, and contained much hitherto unwritten history. The able paper by Mr. Arthur Wright, of Brighton, England, on "Profitable Extensions of Electricity Supply Stations," coming from so high an authority, caused a prolonged and animated discussion. This paper introduced arguments for a basis of charges for current that to many members were entirely new and striking. Mr. J. G. White's paper on the "Niagara–Buffalo Transmission Line" also aroused considerable discussion and a cross-fire of apt questions and instructive replies. All the papers are well worth reading and digesting. Very full abstracts of them and the discussions will be found in this and later issues of the ELECTRICAL REVIEW.

The success of the association during the past year under the wise and enterprising management of its retiring president, Frederic Nicholls, has been marked, highly satisfactory to all concerned. The administration has been at all times vigorous and well directed. The new officials, president Samuel Insull, of Chicago, and vice-president A. M. Young, of Waterbury, Ct., are men eminently worthy of the honor, and will, with their associates, see that the interests of this notable association are protected and advanced.

Altogether, the meeting this year was noteworthy. Members had every facility for enjoying all the sights of the celebrated locality, all the privileges of the municipality and various public and private industries being showered upon them with the utmost hospitality. The convention of 1897 was the best, it seems safe to say, and most successful in point of attendance, good fellowship and programme that has been held. The new power plant and the electrical industries which have sprung into existence added much to the pleasure of the meeting, and marked a great advance from the date of the meeting of this association in the same city eight years ago.

SHALL LIGHTING COMPANIES BE COMPELLED TO COMPETE WITH MUNICIPALITIES?

An unsuccessful attempt was recently made in the Illinois Legislature to pass a law allowing municipalities having their own electric lighting plant to sell the product to private consumers. This is as it should be. No municipality should attempt to compete with private enterprise. It is against the spirit of the times. Where a town has owned its own lighting plant, it has generally been found that the light costs more than in cases where it was the product of private capital. If the rates have not shown such to be the fact, the taxes have. The price of light, like the drummer's overcoat, will be found somewhere in the bill, even if it be re-christened under some such name as "deficiency appropriation." Towns and cities had better leave all such business to those who know how to manage it.

AN OBLIGING SUPERINTENDENT.

The president of an electric railway company complained to his superintendent, a Hibernian named Finnegin, that his daily reports of trouble on the line were too long—too wordy. "Cut 'em short," said the busy president. The superintendent's next report of a car off the track satisfied all hands. It was:

"Offagin.
"Onagin.
"Awayagin.
"FINNEGIN."

There was a richness of good things electrical at the convention just ended. It almost overwhelms the editor, who desires to chronicle everything at once. There are many papers and discussions and incidents that will appear, in addition to the very complete report of the proceedings we present this week, in subsequent issues of the ELECTRICAL REVIEW.

Prof. Wm. Crookes, the eminent English scientist, in the midst of all his regular work of investigation, still finds some time to devote to a study of the peculiarities of spiritualism. He is credited with having accumulated a long array of facts which seem to contravene all the known laws of nature, but does not venture any explanation as yet.

This journal stated last week, before the Electric Light Association convened, that Mr. Samuel Insull would probably succeed to the presidency. As a prophet, this time, we are entitled to honor even in our own country.

CONVENTION NEWS AND COMMENT.

"Our Bob" was there looking as cheerful as a Canadian customs officer. This refers to Bob Corey—not Bob Fitzsimmons—he was in Buffalo.

Many of the old familiar faces were missed at the twentieth convention, and the fact that the electrical business is in the hands of the young men was brought home with added truth.

Dr. Wm. M. Habirshaw, the author of the wire bearing his name, was so charmed with the cuisine of the Cataract House that he stayed over an extra day or two. "Just as good as Delmonico's," said he, "and the air is a great deal better."

Mr. C. B. Price, of Boston, tried to telephone to Captain Wm. Brophy, who was at the International Hotel. The telephone operator misunderstood the name and brought the captain of the bell boys to the telephone for Mr. Price to talk to. Who's the joke on?

There was "a hot time in the old town" when the New York special arrived on Monday night. The early birds hired a brass band and drowned the roar of the Falls with their shouts of welcome when the "specials" pulled into the station. The welkin would undoubtedly have rung with the noise had it been working that night.

Mr. Leonard F. Requa, general manager of the Safety Insulated Wire and Cable Company, of New York city, put in an appearance with a more than usually urbane manner. He had come to Niagara Falls by a slightly roundabout road, with the result that he landed among his numerous competitors with a fat order buttoned up tight in his inside vest pocket.

Although secretary George F. Porter will soon assume an important position with a large electrical manufacturing company, it is understood that he has been persuaded to retain the secretaryship of the association for six months longer. This is fortunate for the National Electric Light Association, as Mr. Porter has proved to be one of the most efficient and hard-working officials in its history.

It is understood that the policy which has carried the National Electric Light Association to its present successful position will be changed by the new administration in no particular, unless it be along the lines of progress. With Messrs. Insull and Young at the head of the organization, a prosperous year is assured in advance, as both gentlemen are excellent business men and genuine "hustlers."

Mr. James F. Cummings, the well known patentee and manufacturer of Armorite interior conduit, and Mr. Austin, who is associated with him, took great pride in showing what their system of underground conduit is doing in a practical manner at Niagara Falls. A manhole was lifted in one of the main streets and an exhibition was given of six bare copper circuits, carrying from 500 to 2,000 volts underground in wooden-lined tubes. A number of the old-timers expressed great surprise, but couldn't go behind the returns.

Mr. J. G. White received many congratulations on his interesting paper describing the construction of the Buffalo–Niagara Falls transmission line. The success of the installation was amply demonstrated by Mr. White's statement that the commercial efficiency of the line is 79.6 per cent. The advocates of high-tension transmission were greatly interested in Mr. White's description of the severe tests which were required of the porcelain insulators before they were accepted. It is probable that these were the most severe and thorough insulator tests ever made.

Charley Bragg, of Philadelphia, was among the old-timers present and, as usual, had on hand a brand new crop of stories. One of these, he thought, was entitled to a hearing and discussion at the regular sessions of the association. A well known engineer, whose opinion was entitled to respect, had stated to Mr. Bragg that he could "develop 1,000 horse-power from a single drop of water." After the gentlemen in whose presence the assertion was made had discussed it, called the engineer an idiot and made wagers on how soon he would acquire paresis, the engineer said he thought all would understand his remark when he mentioned that the "drop of water" he referred to was Niagara Falls!

The Mayor and Board of Aldermen of Niagara Falls held a hurried and secret conference after the New York special arrived on Monday night. It was finally agreed that the electrical men could take care of themselves, and that the entire police and detective force of the town should devote their energies to seeing that the electricians did not bunco the innocent cab drivers or flim-flam those ox-eyed country lassies, Libbie and Katie. The chief of police received orders to this effect. So it happened that when, on the following day, six scraggly foreigners and three trained bears came down the street in front of the International Hotel, the chief of police, who had been standing on the veranda, rushed out into the middle of the street, brandished his night stick around his head, and shouted:

"Go back! go back, I tell ye! Go back where ye kim from."

One of the dagoes asked timidly what was the matter and where they were to go.

"Oi don't give a dom where yez go—to h—l is better than here. Go back! There's trouble enuff here now." And they went sadly. The chief explained afterwards that he had only obeyed orders. "Th' poor divils," he said. "Th' only means av support they had in th' wurruld wuz thim three bears, and jist supposin' thim electrical fellers had iver got hould av th' bears!" The chief trembled with emotion at the thought.

President Insull.

Mr. Samuel Insull, the new president of the National Electric Light Association, has been identified with electrical interests ever since he came to the United States from England in the early eighties. First associated with Thos. A. Edison, he afterwards entered actively into the electrical manufacturing field, and was with the Edison General Electrical Company at the time its large shops were projected at Schenectady, in the planning of which he took great interest. On the consolidation of the Edison and Thomson–Houston companies, Mr. Insull became vice-president of the General Electric Company, resigning to accept the presidency of the Chicago Edison Company, in which he has invested largely. Mr. Insull is also interested in several manufacturing companies, and has lately formed an alliance with Mr. R. T. McDonald in the Fort Wayne Lamp Company, which will engage in the manufacture of incandescent lamps at Cleveland, Ohio.

MR. SAMUEL INSULL, OF CHICAGO, PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION.

Mr. Insull is a young man, unmarried, and has been quite successful in all his undertakings.

Three-Cent Fares Upheld.

The Indiana State Supreme Court has upheld the three-cent-fare law, the enforcement of which on the street car lines of the city recently caused much conflict. The decision further complicates matters, as Judge Showalter, of the Federal Court, recently granted an injunction, on the application of the Central Trust Company, of New York, eastern bondholders of the Citizens' Street Railroad Company, holding that the operation of the law impaired the bond contract.

The State Supreme Court says that the legislature undoubtedly had the right to pass such a law. It is believed that Judge Showalter will now modify his ruling, and that the case will be appealed to the United States Supreme Court at once.

Thanks from the Canadian Electrical Association.

TO THE EDITOR OF ELECTRICAL REVIEW:

In pursuance of a resolution passed at the close of the convention at Niagara Falls yesterday, I have the pleasure to tender to you the thanks of this association for the ample and accurate reports of the proceedings published by your journal.

C. A. MORTIMER, Secretary.

Toronto, Ont., June 5.

A Valued Compliment from President Joseph Howard, Jr., of the New York Press Club.

TO THE EDITOR OF ELECTRICAL REVIEW:

As an old-timer, and a new one as well, I must congratulate you on the uniqueness of the cover of your newsy and instructive REVIEW.

You deserve all the success that comes as a normal harvest after intelligent sowing.

JOSEPH HOWARD, JR.

New York, June 10.

The Latest News.

The Flushing Gas and Electric Light Company has been incorporated, with a capital of $300,000, to operate in Flushing, Queens County. The directors are Charles Whitehead, Fred J. Witt and S. Franklin Defreee, of New York city.

Six coaches of the Alley Elevated, Chicago, were sent to Schenectady, N. Y., last Saturday, where they will be fitted with electric motors. Then they will be brought back to Chicago for use on the "Alley" when electricity replaces steam. This is the first step in the equipment of the South Side elevated with the electric system.

The ELECTRICAL REVIEW, alone among electrical papers, announced last week the arrest and release on $40,000 bail of J. W. Sands, former secretary of the E. S. Greeley & Company, on the charge of embezzlement. Sands is said to be in Europe, and, through his friends, has made full restitution of the funds misappropriated, amounting to some $65,000.

Prof. Edward Weston, of Newark, N. J., rescued a young lady from drowning from a capsized boat in the Hudson River on Sunday. Professor Weston was with a party of friends on his naphtha yacht when they saw the accident. Miss Alvina Guilmette was the young lady rescued; her brother, A. S. Guilmette, and cousin, W. M. Smith, were drowned before Professor Weston's boat could reach them.

City Works Commissioner Willis, of Brooklyn, has granted to the Amsterdam Electric Heat and Power Company a permit to open streets and lay conduits. This was in conformity with the writ of mandamus granted by the Supreme Court during the last week. The Amsterdam company is the assignee of the State Electric Light and Power Company, which received a franchise from the Board of Aldermen in 1895. The permit, as was stated last week, was at first refused.

Mr. J. E. Ham was arrested last week on the charge of embezzlement from his former employer, Mr. W. R. Brixey, the manufacturer of Kerite wires and cables. Former Assistant District Attorney John F. McIntyre, who appeared for the prosecution, declared that the books of the concern showed a deficit of $4,000, and that it was believed that the shortage would amount to more. The specific charge was the larceny of $82.30, which it is alleged Ham collected from a Maiden lane jeweler last December and appropriated to his own use. His bail was fixed at $2,500 and he was released, and claims to be able to prove his innocence of the charge.

ELECTRICAL EQUIPMENT OF THE "GERMANIA" BUILDING.

NEW HOME OF MILWAUKEE'S PROMINENT PAPER

Among the representative German newspapers of the United States, the *Germania*, of Milwaukee, Wis., has for years occupied a high rank in newspaperdom. Founded 24 years ago, it has steadily advanced until to-day its influence and prestige extend over an ever-widening circle of readers throughout this and other countries. When about a year ago it was found that the building so long occupied would no longer accommodate the increasing business, Mr. Geo. Brumder, the proprietor, decided to erect a substantial, modern edifice and incorporate in it all the latest devices in the way of time and labor-saving apparatus.

MR. A. M. PATITZ, DESIGNER AND SUPERINTENDING ENGINEER OF THE "GERMANIA" PLANT.

Naturally the question of power transmission was an important one, and it was finally decided to use electricity, not only for illuminating purposes, but wherever it could be advantageously employed to operate the numerous presses, paper cutters, linotype machines, stereotyping and bindery apparatus and other appliances necessary in a newspaper building. While there is, of course, a number of interesting features, mechanical and otherwise, the electric features will prove interesting to our readers.

The building is a substantial eight-story and basement structure, but only the basement, seventh and eighth floors are occupied by the *Germania*, the first to sixth floor inclusive being divided into offices of varying sizes.

FIG. 1.—"GERMANIA" BUILDING, MILWAUKEE, WIS.

The larger and best lighted part of the basement is of course given up to the press room, the balance of the space being divided into the boilers, engine and dynamos, pump, elevator and a large store and freight receiving rooms.

The satisfactory manner in which the many often perplexing problems of space were solved reflects much credit upon the ability of Mr. A. M. Patitz, the consulting engineer who designed and superintended the plant in all its details. Three Stirling water-tube safety boilers supply steam. A coal conveyor takes the coal from hoppers under the sidewalk, and carries it underground a distance of 75 feet, delivering it either in front of the boilers or into bins above, according to whether manual or mechanical firing is being done, the boilers having mechanical stokers. This coal conveyor is driven by a five-horse-power "Northern" motor, running at a speed of 700 revolutions per minute.

The engine and dynamo room (see Fig. 3) contains two 10 and 20 by 12-inch Westinghouse compound engines, each coupled direct to an 80 kilowatt Siemens & Halske six-pole, compound-wound generator; capacity, 640 amperes at a pressure of 125 volts.

In addition a 65-horse-power Westinghouse Junior engine is provided, coupled direct to a 40-kilowatt 125-volt dynamo built by the Northern Electric Manufacturing Company. The three generators are connected through equalizing bars at the switchboard so that any one can be run singly, either two in parallel or all three in multiple, as may be desirable.

The handsome switchboard is made up of three panels of inch Tennessee marble, set in a substantial iron frame, containing the usual instruments for such installations.

In addition to the 1,800 incandescent lights distributed throughout the building, 18 Pioneer inclosed arc lamps are used on the main floor and outside of the building. The entire lighting system is under perfect control from the dynamo room.

The switchboard was built by the well known firm of Jul. Andrae & Sons' Company, who were the electrical contractors, and did the construction work from the switchboard to dynamos, motors and lamps throughout the building. Interior iron-armored conduit is used, containing some 37,000 feet of Okonite wire or cable, varying in size. Standard Underground Cable Company's lead cable was used when required. A raceway from the top floor to the basement, with a distributing closet and tablet on each floor, provides a ready means of accessibility to every wire. A view of one of the closets is shown in Fig. 4. There is also a watchman's time detector system of 25 stations and a set of 150 telephone wires for use of the several offices. These wires are run from each office to the distributing box on the building, local battery wires leading to a special battery shelf in the storeroom.

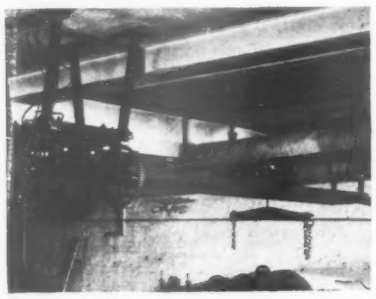


FIG. 2.—ELECTRIC MOTOR APPLIED TO PAPER LIFT.

Our illustration gives a good idea of the manner in which the presses and other machinery are driven by direct-connected Northern motors. Each motor is geared direct to the press, the motor starting and reversing rheostats being mounted in some convenient place as shown in Fig. 5.

The presses and their motors are: One Seymour inserter, 15-horse-power; one Seymour-Webb perfecting, 10-horse-power; two Potter two-revolution, each three horse-power; two Gordon jobbers, each two horse-power; one Potter drum cylinder, one Cottrell drum cylinder, one Campbell drum cylinder and one Cottrell, each one horse-power.

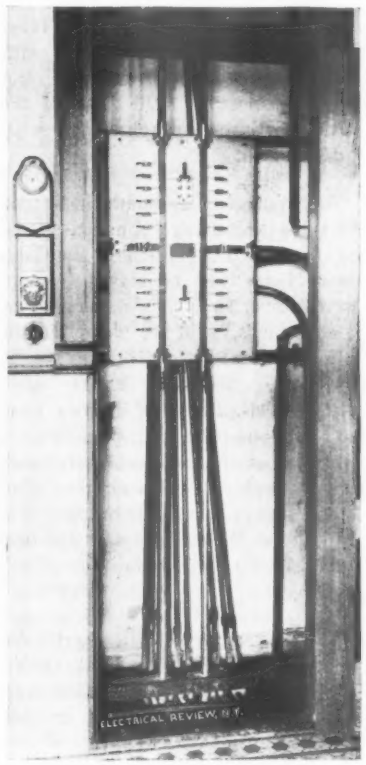


FIG. 4.—INTERIOR OF CLOSET, SHOWING DISTRIBUTING TABLET ON EACH FLOOR.

In the composing room two two-horse-power motors are geared to a jackshaft driving eight Mergenthaler Linotype machines, only one motor being in use at a time; this is the only place in the building where a reserve motor is provided to guard against even the remotest chance of the all-important Linotype machines being disabled through want of power.

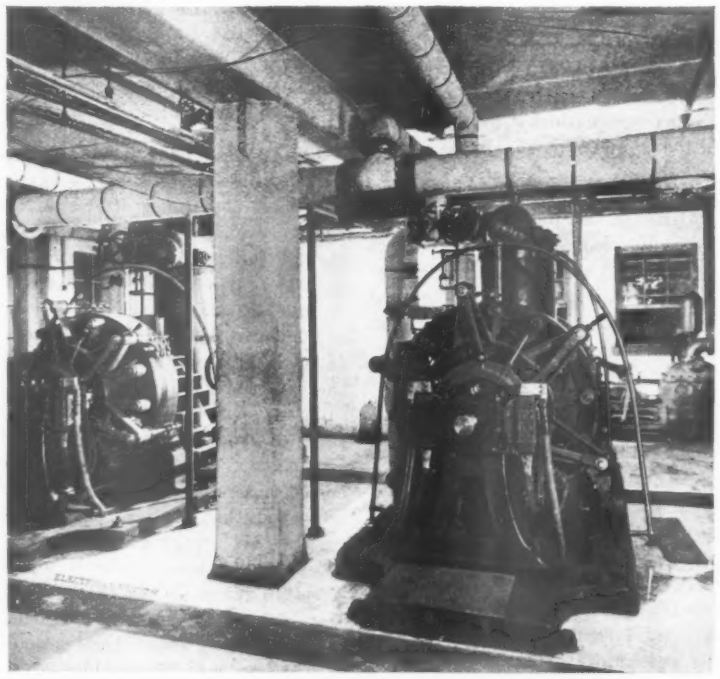


FIG. 3.—DYNAMO ROOM, "GERMANIA" BUILDING, MILWAUKEE, WIS.

A three-horse-power motor in the stereotyping room drives the metal-sawing, plate-trimming and other machines. The several trimmers, routers, etc., in the electrotyping room are driven by a five-horse-power motor.

A one-horse-power motor drives the

machinery of the large bindery. A one-horse-power motor placed on the ceiling near the large Seymour–Brewer press, enables the attendant to handle and place the large rolls of paper in almost as little time as it takes to tell.

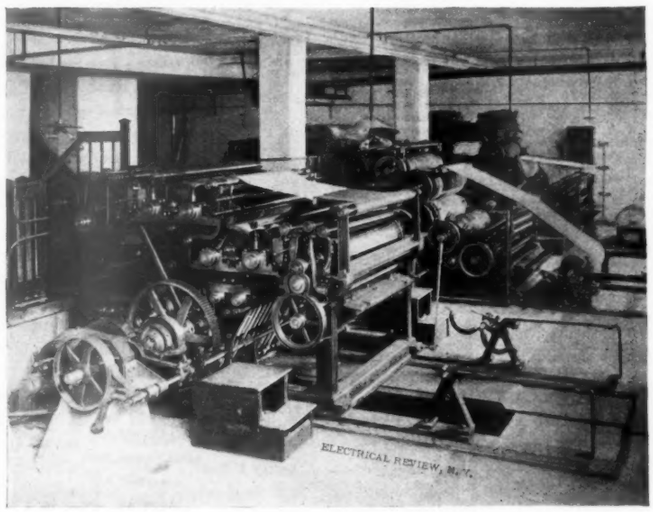


FIG. 5.—ELECTRICAL EQUIPMENT OF "GERMANIA" BUILDING.—A VIEW IN PRESS ROOM SHOWING NORTHERN MOTORS COUPLED DIRECT.

All the motor-starting switches, rheostats and controllers were furnished by the American Rheostat Company, of Milwaukee, and were built especially for this contract. They contain all the latest desirable features of that company's products, mention of which was recently described in the ELECTRICAL REVIEW.

C. E. K.

June 6.

TELEPHONE NEWS AND COMMENT.

The annual meeting of the Erie Telegraph and Telephone Company was held last week. The annual report showed a very successful year.

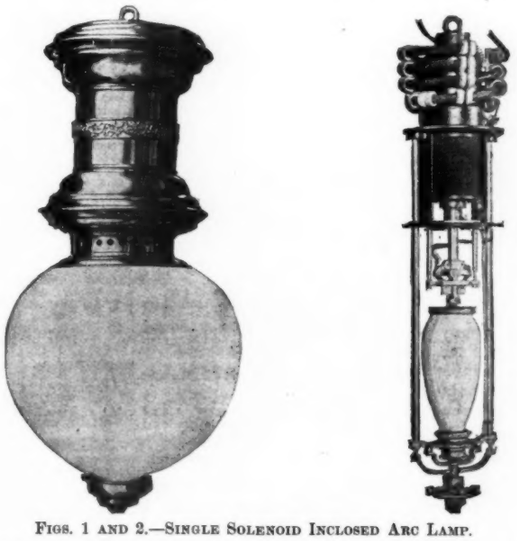
At the annual meeting of the International Bell Telephone Company, Limited, of New York, held a few days ago, the following directors were elected: S. D. Babcock, G. G. Hubbard, L. A. Von Hoffman, R. A. McCurdy, C. T. Lewis, E. S. Converse, F. C. Thieriot, H. S. Randall and L. A. Thebaud.

The City Council of Tiffin, Ohio, has granted a 25-year franchise to the Home Telephone Company, in which a number of the leading business men of Tiffin are interested. The company is allowed a year to complete the plant, but work will commence at once. The rates are $24 for business houses and $18 for residences.

A merchant in an eastern city not long ago happened to meet a business acquaintance in a public station as he was paying for a 30-minute conversation with Chicago and smiling over it. The merchant's comment upon the size of the transaction was met by the remark that a trip to Chicago had been saved and $500 made on the order which had just been taken by telephone. This incident serves to illustrate one of the strongest points of the long-distance telephone—its value as a business factor in large transactions which require a personal interview.

The New General Electric Inclosed Arc Lamp.

The existence of a demand for a short inclosed arc lamp for vestibules, hallways and restaurants, and in places where the ceilings are low, has invited the creation by the General Electric Company of a single solenoid lamp to meet it. This lamp is ornamental in appearance, and measures only two feet in length over all. It is designed for use on 110-volt circuits, the potential at the arc being 80 volts. As in many cases for interior lighting, a short ornamental lamp is desired, not giving as strong an illumination as the standard five-ampere lamps. This lamp is also built to burn at three amperes, with three-eighth-inch carbons and a carbon life of 75 hours.



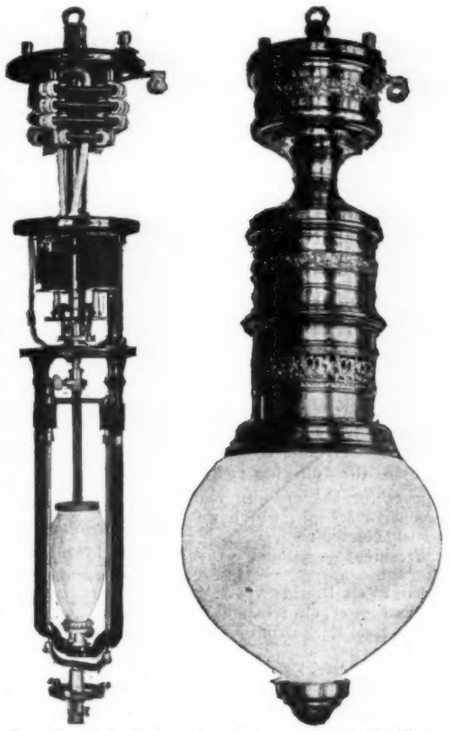
FIGS. 1 AND 2.—SINGLE SOLENOID INCLOSED ARC LAMP.

The lamp mechanism consists of one magnetic spool or solenoid, which attracts through its center a tubular armature surrounding a brass tube, through which the upper carbon is fed. To the lower end of the tube is attached a clutch, which grips the carbon itself instead of the carbon rod. The upward pull of the solenoid is cushioned in two air dashpots at the top of the tube. This gives a steady lift to the upper carbon, which can drop instantly when released.

The current is taken by the carbon from a brass tube with a contact device, consisting of a series of flat springs pressing upon the interior of the tube. The contact device slides freely in the tube, and gives perfect contact in all positions. When trimming the lamp, the upper carbon is pushed up into a spring slip in the contact device, where it is held securely without set screw or clamp. The five-ampere lamp has a carbon life of 100 hours and uses seven-sixteenths in. carbons. It is provided with three loops in the spool winding, by means of which the lamp may be adapted to four, four and one-half or five amperes, as desired. The five-ampere lamp is similar in appearance to the three-ampere lamp, and can also be fitted with weather-proof casing for out-door service.

A phenomenal record has been made in the sale of the inclosed arc lamp of the General Electric Company; between 7,000 and 8,000 are now in commercial service, and the company report a constant duplication of orders. The Hartford Electric Light Company has in use over 450 of these lamps, and in many instances single customers throughout the country are using more than 100. These lamps require 80 volts at the arc, the difference between the voltage at the arc and the voltage at the terminals being taken up by a resistance contained within the lamp. The standard current is one-half to five amperes, and the lamp is made in two lengths, 37 inches and 47 inches, one-half-inch carbons being the standard. The mechanism consists of a single pair of magnet spools operating a clutch, which feeds the carbon rods. All the parts are peculiarly accessible.

In addition to the arc lamp for 110-volt, continuous-current circuit, the General Electric Company has also placed on the market a series inclosed arc lamp for 220 and 500-volt circuits, similar in appearance to their ordinary inclosed arc lamp. The mechanism, however, differs. The regulation is effected by the differential action of a shunt magnet and a series magnet. An automatic cut-out, shunting the circuit through a special resistance within the lamp, which allows each lamp to be thrown in or cut out without changing the potential of the others and, therefore, without interfering with their action. No external rheostat is required.



FIGS. 3 AND 4.—SERIES INCLOSED ARC LAMP, 220-VOLT AND 500-VOLT CIRCUITS.

The working potential is 80 volts at the arc, and the current used is five and one-half to five amperes. Two lamps may be run in series on 220 volts, or five on 500-volt railway circuits, and the range and voltage within which they will operate is such that if adjusted for 500 volts they will operate satisfactorily on any voltage from 450 to 550—a range of 20 per cent. These series inclosed arc lamps are made for indoor and outdoor service.

Des Moines, Iowa, has decided to try the experiment of a municipal electric lighting plant, and will enter into a contract with a private firm to build a plant of an approximate value of $105,000, the city to furnish the site. This plant is to have capacity for 600 arc and 1,500 incandescent lights, and the company is to operate and maintain it, furnishing the city with 500 arc lights and the full number of incandescent lights. For this service the city is to pay $55,000 per annum, and at the end of six and one-third years the plant, in good repair, is to be turned over to the city for the nominal consideration of $1.

THE CONVENTION LAST WEEK.

(*Continued from page 285.*)

the great loss that the association has met with during the past year in the death of our esteemed active members, Mr. Harrison J. Smith, of New York, and J. M. Orford, of Boston. They were always with us, they were in attendance, I think, at every convention. We knew them as friends, we admired them as business men, and as men foremost in their respective callings. Although it is not necessary to adopt any formal resolution, I thought it was not fitting that this meeting should close without some reference by the chair to the loss that the association has sustained. If there is no other business a motion to adjourn will be in order, and the active members will remain for executive session.

On motion of Mr. John A. Seely, of New York, the convention then adjourned to executive session.

ELECTION OF OFFICERS.

The special committee on nominations, consisting of Chas. R. Huntly, John A. Seely and H. H. Fairbanks, reported the following ticket for the officers for the ensuing year to the executive session, which was unanimously elected:

President — Samuel Insull, of Chicago.

First Vice-President—A. M. Young, of Waterbury, Ct.; second vice-president—Geo. R. Stetson, New Bedford, Mass.

New members Executive Committee —W. Worth Bean, St. Joseph, Mich.; W. McLea Walbank, Montreal; F. A. Gilbert, Boston; E. H. Stevens, Elizabeth, N. J.

Former members holding over—W. R. Gardener, John A. Seely, G. A. Redman, A. J. De Camp and H. A. Wagner.

The convention adjourned *sine die*.

Convention Notes, Incidents and Personal Mention.

Dr. W. M. Habirshaw, the widely known chemical expert and the head of the India Rubber & Gutta Percha Insulating Company, manufacturers of insulated wires and cables, found much to interest him at this convention. This was one of the few occasions that he has been able to get away from New York city long enough to take in an entire convention. Messrs. J. W. Godfrey and F. W. Harrington, of the same company, were present and distributed to their friends a very neat souvenir button with an American flag neatly painted in the center, and one of silk gracefully waving from the pin.

One of the neatest and most popular souvenirs at this convention was a silver key containing a lead pencil. These were generously distributed by Major W. L. Candee and Mr. George T. Manson, of the Okonite company. The head of the pencil was surmounted with the trade-mark of the Okonite company very prettily and unobtrusively engraved. Although the demand for these keys was very large, the supply did not seem to give out, and it was evident that the donors were well stocked.

A very handsome paper-weight was distributed by Mr. P. H. Ackerman and Mr. John Carroll for the American Electrical Works, of Providence. It was composed of a small section of the feeder cable used in the Niagara Falls–Buffalo transmission line, and was gotten up in the attractive style that characterizes everything done by this high-grade house. The section of cable was mounted on a silver plate. These were very appropriate souvenirs of the Niagara Falls Convention and were most acceptable to all who were able to secure one.

One of the most enjoyable affairs at the convention was a fish breakfast, given by the Hon. Charles R. Huntley, Park Commissioner of Buffalo, to a number of his electrical friends, at Lewiston, on Wednesday morning. There were a dozen or more in the party and they will never forget that breakfast. Among the gentlemen invited were President Nicholls, and Messrs. Hamill, Gilbert, Ridall, Baker, Candee, McKinlock, McQuaide, Price, Brackenridge and Greene. The breakfast was at 7.30 A. M., Wednesday, and although quite a number of the party were up late the night before attending committee meetings, there were few absentees when host Huntley called the roll around the banquet board. The ride down the gorge road was made in a special car and was particularly invigorating and attractive at that early hour.

Mr. Charles A. Bragg, of Philadelphia, was present with three new stories, each one a side-splitter. Mr. Bragg is one of those genial and capable gentlemen who combine a practical business ability with an occasional glimpse at the humorous side of things.

The regulars among electric lighting men who have always been counted upon before, but were not present at this meeting, were A. J. DeCamp, of Philadelphia; M. J. Francisco, Rutland, Vt., and E. F. Peck, Brooklyn. Mr. Chas. E. Newton, of the Jewell Belting Company, who has been counted one of the safeguards of all conventions, was detained at Detroit, and was abundantly missed at Niagara Falls. Mr. C. L. Tolles, of Hartford, was the handsome representative of Mr. Newton on this occasion, and made the numerous friends of his company happy by presenting them with a pocket-book made of the finest leather, and warranted to always keep filled with greenbacks and never to wear out.

Mr. W. W. Low, president of the Electric Appliance Company, Chicago, was an active representative of his company at the convention, and is one of the younger men of the electrical supply business who has made a pronounced success in that field. His friends were given a neat score record for baseball games.

Mr. George A. McKinlock, president of the Central Electric Company, Chicago, spent several days at Niagara Falls greeting his large circle of friends in the electrical field. His company is now celebrating its 10 years of existence in exclusively electrical supply business, and it ranks as one of the best and most important houses in the United States. Mr. McKinlock made a flying trip to Boston before returning to Chicago.

Both the International Hotel and the Cataract House were complimented for the attention and courtesy they extended to the visitors. The proprietor and officials of the International are particularly deserving of compliment, as it was here where the greatest crowd assembled, and where there was a lively movement evident at all hours of the day and night, yet nobody seemed disturbed and everything passed off smoothly.

THE ATTENDANCE.

The following names were registered at the association headquarters during the convention:

NEW YORK.

F. W. Harrington, Luther Stieringer,
E. O. Johnson, Thorburn Reid,
Willard L. Candee, Alex Henderson,
George T. Manson, Arthur Williams,
E. H. Peck, F. C. Ackerman,
Samuel A. Chase, F. B. Baker,
W. F. D. Crane, Herman A. Straus,
J. P. Williams, D. C. Durland,
H. W. Benedict, John I. Beggs,
P. H. Hover, J. W. Godfrey,
J. H. A. Struck, M. K. Eyre,
J. W. Lieb, Jr., C. O. Baker, Jr.,
W. M. Habirshaw, H. B. Jagoe,
Elmer P. Morris, C. E. Estabrook,
Stephen L. Coles, D. E. Newell,
W. J. Johnston, A. H. Mustard,
Franklin A. Johnston, E. W. Rockafellow,
John I. Solomon, J. C. Lott,
T. E. Hughes, W. McCullough,
George L. Wiley, Jos. Wetzler,
Nelson W. Perry, F. R. Upton,
Chas. D. Shain, A. W. Harvey,
J. McGhie, N. D. Webster,
Joseph Sachs, Marcus Nathan,
Chas. T. Child, G. W. Swan,
John T. McRoy, E. A. Leslie,
H. T. Edgar, B. E. Greene,
W. T. Hunt, Chas. W. Price,
E. L. Powers, A. B. Clements,
H. M. Sweetland, Geo. R. Mac Intire,
Chas. I. Hills, Stewart W. Wise,
Jas. P. McQuaide, E. E. Russell Tratman,
T. C. Martin, R. B. Corey,
K. G. Martin, Stephen A. Douglas,
W. F. Osborne, Geo. F. Porter,
L. B. Marks, Stephen H. Goddard,
Thos. I. McLeod, F. Jarvis Patten,
T. Kieley, J. G. White,
Wm. J. Hammer, Albert B. Herrick.

PHILADELPHIA.

Herbert Lloyd, Geo. L. Peeples,
T. Carpenter Smith, E. L. Nash,
Sanford Bilyea, A. V. Dee,
J. Sigg, John Mustard,
J. H. Vail, A. H. Jones,
Geo. M. G. Holman, E. Ward Wilkins,
J. F. Stevens, J. W. Perry,
Henry B. Cutter, Thos. L. Townsend,
Henry Clay, C. A. Bragg.

CHICAGO.

C. D. Wilkinson, F. S. Howard,
Thos. G. Grier, E. H. Allen,
W. B. McDonald, Edw. R. Grier,
J. A. Radford, Geo. A. McKinlock,
M. J. Isaacs, Chas. F. Medbury,
Samuel Insull, Fred. De Land,
L. A. Ferguson, F. L. Perry,
Joseph Kittlestrings, W. A. Kreidler,
C. A. Ross, R. A. Swain,
W. L. Arnold, George Cutter,
W. W. Low, John Young.
J. Holt Gates, C. H. Wilmerding.
Maurice Coster,

NIAGARA FALLS, N. Y.

A. Schoellkopf, Arthur C. Hastings,
J. F. Rothsay, W. Phillips,
Frank G. Lott, Joseph P. Devine,
W. E. Tuttle, E. F. Price,
Frank Le Blond, W. Caryl Ely.
Geo. E. Cox,

MONTREAL.

R. S. Kelsch, Chas. Morton,
Ernest Carus-Wilson, W. M. Lea Walbank,
Chas. A. Carus-Wilson, John Carroll.
A. E. Smaill,

BOSTON.

H. H. Brooks, Chas. B. Price,
Fred M. Kimball, Chas. B. Davis,
J. H. Mason, Jas. Bradley,
Sidney B. Paine, M. H. Baker,
A. R. Bush, R. S. Hale,
Caryl D. Haskins, D. F. Urquhart,
Jas. I. Ayer, F. E. Barker,
B. G. Underwood, H. P. Moore,
F. B. H. Paine, Geo. W. Davenport,
Wm. Brophy, A. R. Bush.

BUFFALO.

Geo. Urban, Jr., C. G. Gartland,
J. O. Cushing, C. R. Huntley.
T. C. Frenyear,

LOS ANGELES.

H. C. Hybro, W. J. Barrett.

NORFOLK, VA.

John B. Whitehead, Jr., Jas. L. Belote.
Wm. M. Chamberlain,

PITTSBURGH, PA.

W. K. Dunlap, J. C. Calisch,
Jas. F. Cummings, F. M. Laughlin,
W. S. Elliott, F. S. Smith,
C. B. Humphrey, Chas. F. Scott,
C. E. Skinner, Benj. G. Lamme,
J. McN. Bennie, Thos. Cooper,
Ernest H. Heinrichs, D. D. Dickey.
J. S. Crider,

WASHINGTON, PA.

Wm. P. Wieman.

TORONTO.

E. B. Biggar, W. F. Johnson,
Frederic Nicholls, John Langton,
F. C. Armstrong, E. D. McCormack.
Geo. W. Watts,

WARREN, OHIO.

W. D. Packard.

FOSTORIA, OHIO.

H. A. Tremaine.

JACKSONVILLE, ILL.

J. P. Doan.

OTTAWA.

John Murphy.

MILWAUKEE.

William Wilson, Thos. R. Mercein.

AULTMAN, OHIO.

A. L. Daniels.

PROVIDENCE, R. I.

Robert Fessenden, Geo. E. Claflin,
John I. Drake, Wm. C. Woodward.

BIRMINGHAM, ALA.

J. M. Bradley.

LA CROSSE, WIS.

F. A. Copeland.

RENOVO, PA.

F. M. Noecker, James Murphy.

CLEVELAND, OHIO.

Thos. E. Adams, Bailey Whipple,
Geo. M. Hoag, R. C. Foster,
H. Whitford Jones, W. J. Mac Connell,
Herbert P. Glidden, M. C. Canfield,
S. M. Hamill, J. R. Prentiss,
A. D. Spear, W. H. Lawrence,
H. J. Douds, Geo. R. Lean,
W. S. Rogers, Samuel C. D. Johns.
John Rice,

NEWTON, MASS.

W. E. Holmes.

NEWARK, N. J.

A. D. Page, Henry Hayes,
John Gaffney.

CAMBRIDGE, MASS.

F. H. Raymond.

ANTWERP, BELGIUM.

Louis Schaffer.

LYNN, MASS.

W. D. A. Ryan,

PEABODY, MASS.

M. L. Livingston.

EASTON, PA.

Howard Renek.

NEWPORT, N. H.

Wm. F. Richards, M. W. Tenney.

MARLBORO, MASS.

H. Bottomley.

SYRACUSE.

H. A. May, T. J. Gorke,
Paul T. Brady, H. B. Crouse,
S. B. Van Rauss, L. W. Emerick.

RUTLAND, VT.

W. Parsons.

HOLYOKE, MASS.

S. B. Winchester.

NEW PHILADELPHIA, OHIO.

O. P. Taylor.

ST. JOSEPH, MO.

C. E. Roehl.

FENTON, MICH.

D. W. Peabody.

JONESBORO, IND.

R. E. Lucas.

MARINETTE, MICH.

G. W. Hanley.

ELIZABETH, N. J.

E. H. Stefens, Foster M. Voorhees.

ATLANTA, GA.

Geo. Sandt, T. J. Harper.

HOUGHTON, MICH.

Jas. R. Dee.

ST. JOSEPH, MICH.

W. Worth Bean.

WILLIAMSPORT, PA.

H. L. Allen.

CINCINNATI, OHIO.

Edw. K. Gillett.

DOLGEVILLE, N. Y.

Henry J. Meyer.

BROOKLYN, N. Y.

L. H. Conklin, S. K. French.
W. S. Barstow.

NEW BRUNSWICK, N. J.

A. J. Jones.

SOUTHBRIDGE, MASS.

Andrew F. Hall.

SAVANNAH, GA.

T. P. Keck.

PERU, IND.

D. A. Schutt, F. D. Covington.

MORRISTOWN, N. J.

A. H. Lynch.

WATERBURY, CT.

A. M. Young, John E. Sewell.

CHATHAM, N. Y.

E. F. McCabe.

BALTIMORE, MD.

W. H. Harding.

SALEM, OHIO,

D. L. Davis.

WILKINSBURG, PA.

John J. Jennings.

CAMDEN, N. J.

Walter E. Harrington, Wynn Armstrong.
E. A. Armstrong,

STAMFORD, CT.

A. J. Purinton.

NORWICH, CT.

Samuel Hurlburt.

TOLEDO, OHIO.

W. S. Smith.

CHARLOTTE, MICH.

W. P. Engel.

DUBUQUE, IOWA.

Horace Torbert.

DETROIT, MICH.

E. E. Phillips, T. J. Austin.
Wm. J. Hartong.

WEST SOMERVILLE, MASS.

F. Elwood Smith, E. S. Sparrow.

AUGUSTA, GA.

W. E. Moore.

DERBY, CT.

Robert E. Wyant.

NEW BEDFORD, MASS.

Geo. R. Stetson, Chas. R. Price.

INDIANAPOLIS, IND.

G. O. Rockwood, Evans Woolen.
C. C. Perry,

WASHINGTON, D. C.

Seymour W. Tulloch.

BROOKLYN, MICH.

L. W. Greene.

UTICA, N. Y.

M. J. Brayton, W. C. Ballds.

WEST CHESTER, PA.

Jas. E. Pyle.

PAWTUCKET, R. I.

Henry A. Pierce, H. C. Adams, Jr.
Orin Smith, Jr.,

SCHENECTADY, N. Y.

S. Dana Greene, J. R. Lovejoy,
G. B. Greene, H. C. Wirt,
Jas. M. Andrews, J. W. Kirkland.

BEN AVON, OHIO.

E. F. Gwynn.

WESTBORO, MASS.

Ralph D. Smith.

WELLSVILLE, OHIO.

D. W. Low.

ROCHESTER, N. Y.

Chas. F. Burns, C. R. Barnes,
J. A. Almstead, Geo A. Redman.

RED OAK, IOWA.

A. M. Miller.

PONTIAC, MICH.

Chas. J. Willis.

JERSEY CITY, N. J.

W. W. Ritzen.

MT. HOLLY, N. J.

Jos. H. Gaskill.

NEW BRITAIN, CT.

T. H. Brady.

TROY, N. Y.

E. G. Bernard.

TRENTON, N. J.

Paul Lüpke.

JEANETTE, PA.

A. E. Carrier.

BALTIMORE, MD.

E. F. Baker, W. H. Lundell.

CANTON, OHIO.

H. M. Lyman.

MANCHESTER, N. H.

J. Brodie Smith.

BRIGHTON, ENGLAND.

Arthur Wright, Henry Reason.

LONDON, ENGLAND.

Wm. L. Madgen.

PEORIA, ILL.

G. A. Schaffer.

COLUMBUS, OHIO.

T. W. Dixon.

SENECA FALLS, N. Y.

N. T. Wilcox.

WOODVILLE, N. H.

Geo. E. Mann.

FORTRESS MONROE, VA.

Geo. O. Squier.

NEW GLASGOW, NOVA SCOTIA.

Fred A. Bowman.

HALIFAX, NOVA SCOTIA.

E. T. Freeman.

WABASH, IND.

F. W. McNamee.

FITCHBURG, MASS.

A. H. Kimball.

(*Continued on page XIX.*)

ELECTRICAL NEWS FROM THE WEST.

E. S. Lea, Chicago manager for the Fessenden Manufacturing Company, of Pittsburgh, reports very gratifying success in the introduction of the company's X-ray machines, recently described in our columns. The construction of the induction coil, whereby any damaged section can be quickly exchanged for a perfect one, is especially noteworthy, and elicits much favorable comment from all users and others interested.

Those readers of the ELECTRICAL REVIEW who were so unfortunate as to be unable to attend the Niagara convention and could not take advantage of K. McLennan & Company's invitation, will do well to so indicate to that enterprising concern, either by mail or personal visit, and if the stock of those unique souvenirs has not been exhausted may have an opportunity to benefit by McLennan & Company's efficient and excellent advertising methods.

The Missouri Telephone Manufacturing Company, St. Louis, reports a very gratifying condition of its business. It has just completed the contract for building and equipping an extensive toll line in Texas, and has just shipped a complete exchange outfit and telephones to Seneca, Kas., whose enterprising citizens will soon enjoy the benefits of modern telephony as exemplified by the Missouri company's apparatus. A new and simple switchboard drop, recently designed by Mr. D. P. Lewis, president of the company, is now being furnished on all orders, and, for durability and simplicity, seems to leave nothing to be desired.

Catalogue No. 4 and Handbook of Information is the title of a neat little booklet just issued by the Farr Telephone and Construction Supply Company, Chicago. The book is the 1897 edition of the company's regular price list, and while primarily intended to cover the telephone supply field, contains in addition a most complete list of other electrical specialties of merit, which, by the way, may be said of all of the company's goods, who handle nothing but what has proved to be absolutely reliable. Dealers and electricians who are desirous of handling a line of first-class telephone and electrical supplies will do well to get the company's special discount sheet.

Concise, complete, compact and convenient are adjectives that may well be applied to the comprehensive catalogue just issued by the Western Telephone Construction Company, Chicago. In a pamphlet of some 56 pages the company presents a complete description, with prices, of its many products, from the simple telephone hook to its latest improved type of multiple switchboard, in which the company claims to have attained the highest degree of efficiency in large modern exchange work. A partial list of users of the company's apparatus, as well as a series of flattering testimonials, are also given, and would seem to be a good exponent of the excellent qualities of the company's apparatus.

The coming convention of the Independent Telephone Exchanges, at Detroit, on the 22d next, promises to be well attended, not only by the representatives of the various exchanges, but by the different manufacturers as well. The Chicago manufacturers will be represented by president P. C. Burns and Manager Dodge, of the American Electric Telephone Company; Messrs. Jas. E. Keelyn and K. B. Miller, of the Western Telephone Construction Company; manager Frank A. Ross, of the Stromberg-Carlsen company, and president C. W. Farr, of the Farr Telephone and Construction Supply Company. Several others have expressed their intention of attending this important initial gathering.

The Gibbs Electric Company, Milwaukee, recently secured several nice orders for some motors through its general agents, Messrs. Kohler Brothers. Among the list may be mentioned Armour & Company, who bought two 10-horse-power, one 15-horse-power, one 20-horse-power, one 25-horse-power and one 30-horse-power, slow-speed multipolar 500-volt motors, while the Western Wheel Works, another representative Chicago concern, placed an order for three 10-horse-power, two 20-horse-power, three 25-horse-power, two 35-horse-power and one 40-horse-power, 125-volt slow-speed motors. While the manufacturers of apparatus of this kind have undoubtedly greatly improved and perfected their machines during the past few years, it must, at the same time, not be overlooked that purchasers are becoming more and more exacting and discriminating in their selection of electrical apparatus, and the selection of Gibbs apparatus in the instances cited seems to speak well for the high quality of that company's products.

C. E. K.

June 10.

A Telephone Cable Laid.

General Superintendent E. B. Baker, of the Southern New England Telephone Company, has just completed the work of laying a cable in the Thames River, extending from Winthrop's Point to Groton Shore. The time occupied in connecting the two points was about one hour. This cable consists of 15 pairs of wires, weighs about 6,750 pounds, and is manufactured by the Okonite company, of New York. This is the second Okonite cable the telephone company have running now between New London and Groton Shore, and both are necessary to accommodate the increasing service of this well managed telephone company.

"C. & C."

In connection with the publication of a description of the reaction type of brush-holder, published in these columns last week, the statement was made that the mechanism was now being used for the first time. This statement is erroneous, as the brush has been used by both the C. & C. Electric Company, by whom the patents are owned, and also by several prominent electrical machine manufacturers on a royalty basis.

THE DIRECT CONVERSION OF HEAT INTO ELECTRICITY.

ADDRESS DELIVERED BEFORE THE NEW YORK ELECTRICAL SOCIETY, THURSDAY, MAY 20, 1897, BY H. BARRINGER COX.

(Continued from page 276.)

The water in the machine has very little to do with it in the way, I think, you judge it does—that the cooler the backs and the hotter the fronts, the greater the output. I do not find that at all. I am a disbeliever in a great many things which have been accepted in connection with thermo-electrics. I have never found any such condition as the one I have just stated, that the hotter you make the hot junction, and the cooler you make the cool junction, the greater the electrical efficiency. I do not believe it. I say, if you get the cool junction too cool you reduce the efficiency of the hot junction. We have to be careful in thermo-electrics not to get the device too cool. A temperature on the outside between 60 and 185, only reduces in a five-volt machine the electro-motive force a few tenths of a volt, and that is not due to the thermo-electric effect, but to the increased internal resistance which, of necessity, causes a natural drop, from the fact that there is no cooling on the back here (illustrating), and the hotter it gets there, the greater the internal resistance. I have tried it with freezing water, and, thinking possibly you would like to try, have had this ice-water provided; you can put on ice-water and see if you can increase the output. I do not think you will. Then you are at liberty to take a machine and run it at a high-water temperature and see if you can decrease it. I do not think you will, conceding the fact of the few degrees of difference due to increased internal resistance. I believe we can gain time now by having a discussion on the subject. I think the problem before us is a practical one, and we have one form of its solution before us. As practical electrical men, I do not think you want to sit here waiting, Micawber-like, for something to turn up. This has turned up. It is here. I wish you to examine and test the apparatus in any way that you desire; it is an ordinary, practical device, which is on the market, and I take pleasure in introducing it for the first time. [Applause.]

President Emery: I suggest that the gentlemen remain seated, and that questions be asked. I suppose there are three machines in series?

Mr. Cox: No, sir; there are three machines, but they are not electrically in series. One is operating this fan motor, the other one this, and the current of the third one is not being used—each one is independent.

Mr. Emery: What is the voltage of each machine?

Mr. Cox: 2.5 volts, 4.5 volts, 10 volts.

Mr. Emery: What constant current can you maintain?

Mr. Cox: The current is constant; the reading should be taken as though it was a primary battery without polarization.

Mr. Emery: In doing work continuously what is the output?

Mr. Cox: The output of this machine, when it is properly supplied with gas (the pressure is low to-night), is 10 volts on open circuit and three amperes on closed circuit. This one four volts 4.5 amperes.

Mr. Emery: How many couples in one of the batteries?

Mr. Cox: 75; 15 in a row. A row is made as one couple. The couples in this machine are a half-inch thick, and in this one, a very small couple, not over a quarter-inch thick; the quarter-inch is a high-voltage machine. The half-inch couple machine runs between four and five volts; the quarter-inch runs between 10 and 12 volts, being practically the same size. The machines we ordinarily sell are listed as between four and five volts. For high voltage the ampere is less; for low voltage the ampere is more.

Mr. Sachs: How many couples are there in the ten-volt machine? I would like to make a mental calculation to get at the volt per couple. That would be an interesting point to find out whether it was different in the two sizes of machine, from the ten-volt to the four-volt machine, or whether it remains constant for the different sizes.

Mr. Cox: The voltage of the thermo-electric element is entirely due, in so far as my observation goes, to the metal used, except granting a slight variation when the backs are maintained at 60 or 70 degrees, or when they are allowed to heat to as high as 185 degrees.

Mr. Sachs: How many couples are there in a ten-volt machine?

Mr. Cox: I would really have to guess; I don't know.

Mr. Sachs: There are 75 in the four-volt machines?

Mr. Cox: Yes; and I should judge there were four times the number in the ten-volt machine.

Mr. Sachs: If the voltage increased directly with the number of couples, there ought to be two and one-half times the couples in the ten-volt machine.

Mr. Cox: You are going to the theoretical and not the practical; you can not run a couple of that size to any such heat as the larger ones.

Mr. Sachs: The heat has the same effect on the element.

Mr. Cox: Not always; you can take an extremely low heat and melt a metal which has but small bulk, such as the size of this pencil point. For instance, lead in bulk will melt at a certain point; but in practical work we know that a lead wire will melt below the point of the bulk metal—the quantity of heat must be considered. A large bulk of metal requires the same temperature as the small bulk, but more of it. In the small sized couples, theoretically, they should stand the same heat as the large couples; practically, they can not.

Mr. Sachs: Would it not bring them up to the higher efficiency to get the same voltage with half the number of couples?

Mr. Cox: I show this machine of 10 volts more as a matter of curiosity. I could build you a machine with an output at the rate of seven couples to a volt; and you can imagine what the output in electro-motive force would be with 200 couples—very nearly 30 volts.

Mr. Sachs: The ampere output decreases where you increase the voltage?

Mr. Cox: No—considering this machine before us—the higher the heat applied to its interior, up to a certain point, the higher the voltage, and the higher the voltage the higher the ampere output; but the greater the heat in the interior of the machine the higher is its internal resistance.

Mr. Sachs: I think that would bring down the amperage.

Mr. Cox: That is what it does. That is the reason I am not trying to work for high voltage.

Mr. Lieb: I do not think the audience understood—I certainly have not—what is the output in watts in the external circuit that the four-volt machine is capable of maintaining continuously with two and one-half feet of gas per hour.

(To be continued.)

ABSTRACTS OF PAPERS READ AT THE TWENTIETH ANNUAL CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION, AT NIAGARA FALLS, JUNE 8, 9, 10, 1897.

"RECENT PROGRESS IN ARC LIGHTING," BY ELIHU THOMSON.

It is now six years since I read a paper on "The Electric Arc and Its Use in Lighting" before this association. Since that time considerable technical advances have taken place in this important field, and a continuous commercial expansion of arc lighting as an industry has resulted.

We have, to-day, in actual commercial use arc lamps running under quite a variety of conditions as to nature of current, regulation of the current, and conditions concerning the arc itself as a source of light.

According to the manner in which the arc lights are worked on an electric circuit, we are enabled to make several general divisions, about as follows:

Series arcs on	Constant, continuous-current circuits. Constant, pulsating-current circuits. Constant-potential, continuous-current circuits. Constant, alternating current circuits.
Single arcs on	Branch of constant-potential, continuous-current circuit. Branch of constant-potential, alternating-current circuit. Compensators with alternating current. Constant-current transformers.

It will, at this time, be scarcely necessary to dwell upon the main features of several of the cases above enumerated, as they are too well known to call for comment here. On account of the relatively higher potential demanded by an inclosed arc, and the consequent restriction of the number of lights in a series with a given permissible voltage, there has naturally resulted thus far very little real commercial use of series inclosed arcs, and where they have been on trial use they have, in most cases, so far as the writer is aware, been discontinued.

The dynamos for constant-current arc lighting are not so efficient as high-class, constant-potential machines, but as the running of arcs with constant-potential, continuous currents demands that, for steadiness or stability, dead resistance or other additional apparatus, more or less wasteful of energy, be used in the lamp branches, what may be gained in one way is likely to be lost in another.

In recent years machines capable of working 125 to 150 arc lights in a series have been developed successfully. But the potential between terminals in such a case may be 7,000 volts—often too high for security, and in some places forbidden by special legislation. An ingenious method of employing such machines when, as in the case with the Brush machine, several commutators are present in series relation, has been devised by Mr. Green, of the Brush company. This plan demands that separate pairs of wires be run from the machine to the switchboard for each circuit, but the unquestionable effect of the new connection is to limit the difference of potential which is possible to be manifested between any two parts of the circuit through the machine and lamps.

In such a system, evenly loaded, the highest difference of potential anywhere to be found will evidently be that required to run a series of lights looped between two successive commutators. If, however, lights are cut off one set and added to another, so as to keep the machine in full work with unbalanced loads, then the potential distribution is, of course, disturbed, and the system approaches the condition of all commutators connected directly in series, and the lights all in one series—the old plan.

The immediate future of the series arc lighting system appears to be in the development of large dynamos, up to, say, 300 arc lights each, running at such speeds that one or a pair may be easily coupled directly to the shaft of a moderately high-speed engine. The use of a regulated constant current in the series system, besides giving a simple system as to wiring, etc., is seemingly best adapted to the use of the cheaper carbons. For extended districts the series arc lighting system is still likely to hold its own, but displacement by constant-potential arcs and inclosed arcs on constant-potential circuits will doubtless continue in cities supplied by underground low-pressure sytems with continuous currents.

There is neither time nor space to devote to the details of arc-lamp mechanism for constant-current circuits. There are two points, however, which may be touched upon in this connection, as tending to secure the best results. First, the variation of pull for a given variation of current in the magnets controlling the lamp should be as great as possible. Second, there should be as little as possible variation in the force required to feed or recover from feeding. The force required to be imparted to the mechanism to release the clutch, detent or escapement should be as little as possible, and but a very small fraction of the total magnetic force in a differential or shunt-feeding system. Otherwise, the lamp will not be a sensitive feeder. A good lamp should feed on a variation of three to five volts, and, with certain constructions, a feeding action within one-half to three-quarters of a volt variation for a 45-volt arc can be readily attained.

Two or more arc lamps are now often connected in a branch across constant-potential mains or supply lines. The inevitable use of a choking resistance in series, with arc lamps run from constant-potential lines, is now pretty generally understood. Without it the current in the lamp branch is unstable.

The writer has seen no more perfect result in arc lighting than can be obtained on constant potentials, with good lamps and carbons burning open arcs.

The inclosed arc of to-day merits more than a passing consideration, on account of the general interest which has arisen in regard to it among electric light engineers. The idea of burning an arc in a practically closed and relatively small glass chamber is quite old. It was known also that the carbons would burn blunt or nearly square on the ends, and would require a relatively wider separation to let the light out; that they could be made to burn relatively more or less pointed by letting in more or less air. Early experimenters in this field were met at the outset by the serious difficulty of obscurations of the inclosing vessel by deposits generally brownish, and probably due to oxide of iron, the iron being present in the graphitic carbon used in forming the carbon sticks. The writer met this difficulty in 1879, and for many years after that date there were not to be found such pure carbons as would give so little deposition as is required to work an inclosed arc practically.

Contrary to the original expectation of its promoters, the use of inclosed arcs on series circuits did not progress rapidly and soon retrograded. Many causes, besides the one of reduced capacity of lines, had undoubtedly an effect. Cheap carbons for open arcs, impure carbons for inclosed arcs, breakage of inner globes—resulting in rapid consumption of carbon—obscuration of light, etc., must have contributed largely to the result.

When it is remembered that, to get the best results with arc lamps on constant-potential circuits, the use of rather expensive cored carbons is necessary, the saving of carbon and frequent trimming becomes a very important item and permits the employment of more expensive carbons, provided they last long enough. The high voltage demanded by the inclosed arc was soon seen to be not a disadvantage, but a positive advantage for constant-potential circuits, inasmuch as it permitted the use in one lamp of a larger fraction of the total—generally 110 volts. Hence, instead of keeping down the potential, it could even be raised from 65 to 75 or to 80 volts with advantage. In fact, it may be that the exclusion of oxygen has the effect of enriching the arc flame itself, in much the same way that a slightly luminous blue flame of a Bunsen burner becomes far more luminous by cutting off the air. There may, in fact, be free condensed carbon particles in the outer layers of the arc stream highly heated and, therefore, strongly luminous. The flat ends of the carbons tend, also, to cause the hot gases to be retained under the positive end, thus extending the heat of the crater and increasing the luminosity. The result of the almost complete exclusion of oxygen is that very little combustion takes place and the life of the carbon is therefore much extended. The function of the small glass vessel around the arc is not only to keep out the air, but, in addition, to act as a diffuser of the light evolved, and in this sense replace, to a considerable extent, an opal outer globe of large dimensions, necessarily thick and highly absorptive. The inner globe around the arc is made thin, to withstand heat without cracking from sudden changes of temperature, and is generally of clear glass with a thin coating, either internal or external, of an opal or alabaster-like glass, which, by the materials employed in its composition, gives a large diffusive effect without undue absorption. The inner globe is often also given a yellowish color or absorptive effect for the disagreeable violet rays, of which the long arc flame is so strong a source.

Owing to the traverse from side to side of the arc between the square-ended carbons, the direction in which light is emitted from the arc most effectively is undergoing continual and very great changes, so that the intensity of light in any given direction may, in a few seconds, vary several hundred per cent, and with a perfectly clear glass inclosing globe this variation would not only be quite noticeable, but in many cases intolerable. The diffusive power of the glass, however, is such, in the case of the opal coating, that the traveling of the arc is, in large measure, compensated, and the general effect is that of a very steady, uniform light. Were it not for the diffusive power, the color of light, as well as the intensity, would change greatly; as when the arc happened to be on the side of the carbons away from the observer, the light would then be in greater proportion from the purple or violet arc flame, and less from the glowing ends of the carbons themselves.

The carbons to be used in an "inclosed arc" should be of the very highest grade as to purity, not too hard or dense, as straight as possible, uniform in diameter and circular in section, and should be obtained of as near a standard diameter as possible, so as to avoid the necessity for adjusting the caps of the inner globes to the size of the carbons. It is necessary that the caps should fit pretty closely around the carbons to avoid leak and consequent reduction of life. Leaks of air into the inner globe must be carefully avoided, if any reliance is to be placed upon a lamp for a given run without recarboning. During the run the upper part of the inner arc-inclosing globe is coated slowly with a deposit, nearly white in color when the carbons are free from iron, and consisting of what little mineral matter has been left in the carbons. Fortunately, the hot uprising currents from the arc deposit considerable of this on the cap above and return to the arc to be reheated and again circulated at a little above the level of the arc itself, and, as the lower carbon consumption gradually causes the arc to descend, the light of the arc continually reaches portions of the glass wall which have been but slightly obscured by the deposits from prior burning. In general, the deposit which forms on the inner globe can be wiped off or dusted off at the time of recarboning. Carelessness in this particular may easily result in a large proportion of the light of the arc being lost, and, what is perhaps worse, the radiant heat and light of the arc, being unable to escape, goes to overheat the glass of the inner globe, either melting or deforming it so as to produce leaks, cracking it directly or burning the deposits into its surface. After this they can only be removed by such agents as hydrofluoric acid applied to the surface.

The mechanism of an inclosed arc lamp to be run singly in branches from 110-volt circuits is naturally very simple. Since the lamp regulates entirely by variations of current on its circuit, a simple series magnet suffices. No cut-out other than a fuse in the lamp branch is needed.

The switch is a plain open-circuiting switch. A choking resistance is mounted on the lamp or elsewhere in the branch, the drop over which is about 30 volts. The upper carbon or its holding rod is acted on by a simple positive clutch. There is required, however, even in such a lamp, so apparently simple in itself, great care in proportioning the parts and their relative actions, to secure the best results. If the constructor fails in any detail, the behavior of the lamp soon tells the story—the current is interrupted frequently; the voltage around the arc varies greatly; the current, as well as the light of the lamp, varies.

The running of single alternating-current arc lamps on constant-potential circuits is facilitated by the ease with which, by a transformer or compensator, the potential required for the lamp may be obtained.

An alternating arc is peculiar, and different from the continuous-current arc in a number of important particulars. The fact that the arc is extinguished between successive alternations at the zero points of the current wave, and at a rate equal to double the periodicity, results in the musical sound of the arc, which may become a source of annoyance. The same cause gives rise to difficulty in starting the arcs without having them chatter, for until the carbons get strongly heated the arc is not re-established after extinguishment with the carbons separated. With cold carbons, the carbons must touch each other after an extinguishment at the zeros. Hence, the carbons must be separated very slowly, while a large current flows so as to strongly heat their ends, or a higher potential than that to be used in running the lamp after starting must be applied at first. Another way is to employ a resistance or, better, a reactive coil in circuit with the arc lamp, so as to change the character of the potential at the lamp terminals, which then becomes less than that of a constant potential, and, in fact, begins to approach, in a measure, constant-current supply. But in the use of a resistance or reactance in circuit with the lamp, it is, of course, necessary to increase the potential of the line accordingly, so as to give the proper potential to the arc; while both expedients involve a loss

of energy. It is found not to be practicable to run alternating arc lamps on circuits much below 40 cycles; the common rates of 60 and 125 are well adapted to the case.

The efficiency of the alternating arc as a source of light has been shown by Prof. A. E. Blondel, in a recent paper, to be quite variable. It depends on the length of arc used with the particular carbons employed, and on the diameter of the carbons, as with continuous current. It also depends on the form of the wave of the alternating current. It was found that, with a rectangular wave alternating current, such as may be produced by reversing a continuous current by a commutator, the light given out was as 79 to 59 in the case of sine wave currents. This should follow from the fact that the extinctions, as Blondel pointed out, were instantaneous in the first case, and lasted for about one-quarter of an alternation in the case of the sine wave.

The writer takes occasion to express the opinion that, with very flat-topped waves, or waves approaching closely to rectangular waves, the limit of periodicity would be found far below 40 per second, as regards the maintenance of an arc. If the reversal or passage through zero is quick enough, almost any reduction of periodicity would become possible. There are, however, practical considerations which set the limits in such a case.

Soft carbons, or those best suited to readily furnish considerable volatile matter, seem to be best adapted to alternating-current arcs, and they are frequently cored. The color of the light suffers some in consequence.

The use of single arcs across alternating, constant-potential mains requires only that the lamp mechanism be operated by variations of the current passing the arc. Hence, an electro-magnet in series is used to lift and feed the carbons, or sometimes the expansion of a high-resistance wire, traversed by the lamp current, has been applied for the same purpose, as in the "Kester" lamp. The electro-magnet is open to the objection that its action is so instantaneous as to be liable to provoke chattering at starting, requiring a carefully adjusted check, or dash-pot, to prevent such action, and the magnet armature, or core, may also, unless very carefully arranged, produce by its inevitable vibrations a harsh note audible some distance away. Add this to the hum of the arc itself, and it is easy to see that such a lamp may become intolerable indoors in a quiet room. In the use of a hot wire the objection of chattering at the start is overcome without difficulty, and the wire is noiseless in its action; but it demands that considerable energy be wasted in it. If the arc requires 28 to 30 volts, and the regulating wire five to seven volts, it is easy to see that a considerable sacrifice has been made for the result attained, particularly as in the use of hot wire over-feeding is liable to take place. The writer obtained, a considerable time ago, a much better result by using the hot-wire principle, but variably shunting it by a set of contacts controlled by a small electro-magnet in series relation, which addition imparted greatly increased sensitiveness, while the slow start given by the hot wire was still secured.

The arc in the ordinary alternating-current arc lamp appears to be stable, even when the connection is made across constant-potential mains without resistance or reactance in the branch as a check upon the current. Therefore, nearly all the energy may be thus delivered to the arc itself without deduction. This fact tends to neutralize the lower efficiency of light production in the alternating arc, since the continuous-current arc on constant potentials involves a dead resistance loss. Any comparison, then, must, for practical purposes, consider the total energy used in the branch in which the lamp exists, and the light produced or emitted in directions permitting utilization.

While the alternating arc, run from constant potentials, is feasible, the difficulty of chattering and large variations of current at starting result from the arrangement, and any sudden fall of potential may cause a momentary extinguishment. Particularly is this the case when the arc is of the "inclosed," long-burning type. In such case, on account of the greater length of the arc, it is peculiarly sensitive to influences which would affect but slightly the ordinary open-air arc. With the open-air arc a comprehensive set of tests made under the writer's supervision disclosed the fact that various makes of carbon gave widely different results. It was found that the length of arc or separation of the carbons for a given potential was, under equivalent conditions, quite variable, and the curious fact was noted that with some makes of carbon the variation of arc length with variations in the potential of the circuit supplying the lamp were much less than with certain other makes. Some gave excessive variation of arc length with moderate variations of potential at the arc, while others gave only moderate variations of arc length for considerable variation of potential at the arc. Of course, the latter are far the most desirable carbons for practical use. The results in each case were plotted as a curve, and comparison and superposition of the curves showed the superiority of one or another brand. The curves showed also the arc length for each kind of carbons for a given potential across the arc, which it was important to know in selecting carbons best adapted for alternating-current work. The carbon which gave the longest arc at the lowest potential, and one which did not vary its length as much or more than that obtained with other carbons for certain variations of potential, would practically be preferred, other things being equal. It is too early to predict what part the "inclosed" alternating arc may play in the future art of arc lighting, but it probably will find a considerable application.

The larger the arc, or the larger the current in it with a normal voltage, the more efficient is the light production. Measurement shows that where, with continuous current, the same brand of hard carbons is used of diameters varying approximately with the current strength, naked arcs, with 10 amperes and 48 volts, may take for each mean spherical candle-power 1.2 watt, while arcs of seven amperes and 48 volts require 1.4 watt.

Measurements show, after a run of 102 hours, and per each mean spherical candle-power of a four and three-quarter ampere, inclosed, continuous-current arc with clear inner and no outer globe (one-half-inch carbons), an expenditure of 1.94 watt at the arc. While it may seem that the watts per candle are higher than might be expected, yet it must be borne in mind that, in all inclosed arcs, the current is relatively small and the potential high for a given expenditure of energy, and this acts in a double way to lower the efficiency, as not only the crater emitting light is smaller, but a large part of the energy goes to sustain the arc flame, which is long, while, also, the absorption of light by the surrounding glass is not to be neglected. No construction of lamp, regulation or adjustment thereof can get rid of the inherent properties here pointed out. Nevertheless, it is true that the character of the light, both of the open or exposed arc and of the inclosed arc, is such as to make it very desirable as a substitute for daylight and for many cases of use. The fact that the light is shed mainly downward by continuous-current arcs results virtually in an addition to the efficiency and economy of the light; thus, if the light emitted downward be considered as alone useful, the expenditure per mean useful candle would, with naked arcs, fall to about one-half a watt, and with inclosed arcs, to from one to one and one-half watt at the arc.

With alternating arcs the conditions are different, since the light is sent up and down equally. By a reflector placed above the arc, a considerable fraction of the light which would often be lost upward is sent downward to increase the effectiveness; thus, a 16-ampere, 25-volt, naked, alternating-current arc used, per mean spherical candle, 1.49 watt, or for mean useful below the horizontal, 1.12 watt, which was reduced to .8 to .9 watt, when a porcelain reflector above the arc was used. For the same causes that necessarily reduce the efficiency of an inclosed, continuous-current arc as compared with the uninclosed, the efficiency of an inclosed alternating arc falls below that of the open arc with similar currents. The watts at arc per candle will be found, per mean spherical candle, to be, under the best conditions, about two watts, increasing toward the end of the run, owing to obscuration of the inner globe and other causes. No reflector or deflector can be used with much effect with the inclosed arc, so that the mean useful is but little different from the mean spherical candle-power.

The apparent advantage in economy of the continuous-current inclosed arc over that with alternating currents is in large measure neutralized by the fact of the former requiring a dead resistance in circuit to give stability to the current, while the latter can be run without it, or, at most, with a reactive coil which wastes but little energy.

Still, it must be confessed at the end that the luminous yield is but little better than that obtained in incandescent lighting. After all, it may be that the whiteness of the light and the daylight effect obtained may be a sufficient reason for the large introduction of inclosed arcs, now that the frequent trimming and attention to the lamp is not needed. Indeed, it may also appear that all the varieties of arc lighting which have grown into importance within the past few years have their own fields of usefulness, and that, therefore, the work spent in developing them has not been labor in vain.

It should be said, in conclusion, that the figures given above and expressing the watts per mean spherical candle, while strictly comparative so far as a study of arc lights alone is concerned, might vary somewhat if the object had been to compare arc and incandescent lights, owing to the difference in color of light, though the variation would not in any case be great.

THE INDUCTION FACTOR, A NEW BASIS OF DYNAMO CALCULATION AND CLASSIFICATION, BY PROFESSOR CHAS. A. CARUS-WILSON, MONTREAL, CAN.

If a dynamo has A conductors on the surface of the armature, N lines of force per pole and p pairs of poles connected in series, the torque in inch-pounds for C amperes passing through the dynamo can be written

$$t = 1.41\ p\ C\ A\ N\ 10^{-8} \qquad (1)$$

When N is a constant quantity, the only variable in this equation is C; so we can write

$$t = 1.41\ C\ M \qquad (2)$$

where M depends simply upon the number of conductors on the surface of the armature, the number of lines of force per pole and the number of pairs of poles connected in series, and can be expressed thus:

$$M = p\ A\ N\ 10^{-8} \qquad (3)$$

If the armature rotates uniformly at n revolutions per second, the induced volts can be written

$$e = p\ A\ N\ n\ 10^{-8} \qquad (4)$$

Thus $M = \frac{e}{n}$ and may be defined as the induced volts divided by the number of revolutions per second; we may call M the *induction factor* of the dynamo.

If for t we put T, where T is the force at the rim of a pulley of diameter d, equation (2) can be written

$$T = \frac{1}{\pi\ d} M\ C\ 10^7 \text{ dynes} \qquad (5)$$

where d is expressed in centimetres, T in terms of C. G. S. unit of force and C in amperes. If, now, the circumference of the pulley be 10^7 centimetres, i. e., if $\pi d = 10^7$ centimetres, we can express the force of the dynamo thus:

$$T = M\ C \text{ dynes} \qquad (6)$$

The force of a dynamo may thus be defined as a force of M C dynes at the rim of a pulley 10^7 centimetres in circumference. We may call M C the *force factor* of the dynamo.

Since M is the induced volts divided by the revolutions per second, it follows that $C\ M = \frac{C\ e}{n}$; but C e is the rate of doing mechanical work; i. e., the work done per second measured in watts, hence C M is the work done per revolution of the motor at any speed. If, then, we are given C and M, we can find the work per second; i. e., the rate of working, or the power, by simply multiplying the product C M by the revolutions per second.

The induction factor forms a connecting link between the calculation for and the construction of a motor, and since it is the true basis of the dynamical action of the motor, it can be made the subject of calculation and enter into equations of any complexity.

Example 6. We have to design a motor that will draw a car at 13 miles an hour, with a tractive effort of 680 pounds on 33-inch wheels, with gear ratio 4.78 on a 500-volt line, the resistance of the motor being 1.3 ohms. If the mechanical efficiency is 85 per cent, the total tractive effort T must be 800 pounds.

If E be the tension of the line, d the wheel diameter, v the gear ratio, S the speed in miles per hour, R the resistance of the motor, the induction factor is given by the following equation:

$$M = \frac{E\ d}{11.2\ v\ S}\left\{1+\sqrt{\left(1-\frac{8\ R\ T\ S}{E^2}\right)}\right\} \qquad (7)$$

Inserting the given values in this equation, we find M to be 41.7. We also see from the equation

$$T\ d = 2.82\ v\ M\ C \qquad (8)$$

that the current, when running with the given load, would be 47 amperes.

So that the motor must have an induction factor of 41.7 and carry safely 47 amperes; i. e., the force factor must be 1,960 dynes.

The induction factor may be made up in any way that is most convenient. If there are 720 conductors on the armature, and four poles, the armature, being series-connected, giving p=2, we see from Equation 3 that we must have 2.89×10^6 lines per pole. Further, if the motor is series-wound, it must have the specified induction factor for 47 amperes in the field winding.

Equation 7 may be written in the form

$$M = 7.85\ \frac{E\ d}{v\ s}\left\{1+\sqrt{\left(1-\frac{R\ T\ s}{11\ E^2}\right)}\right\} \qquad (9)$$

where s is the velocity measured in

feet per second, and d is the diameter of the rope drum of a crane or elevator.

The current required for any given acceleration is given by the equation

$$a=405\times10^{-4}\times\frac{v}{d}\times\frac{M}{W}\times C_a \qquad (10)$$

where C_a is the current required (over and above the frictional or running current) to produce an acceleration of a foot per second in a mass of W tons (2,240 pounds).

Example 8. We have to start up the elevator car of Example 7 in two seconds; i. e., to get up a speed of 200 feet per minute in two seconds; *a* is then 1 67, and if we suppose the total mass to be moved to be five tons, the required current is 22 amperes, making a total current, at the start, of 152 amperes. The motor must therefore have a force factor of 676 dynes in order that it may start up in the given time.

When the tractive effort, the speed, the tension of the line and the resistance of the motor are given, we can write

$$\frac{M}{d}\frac{v}{}=\frac{E.}{11.2\ S}\left\{1+\sqrt{\left(1-\frac{8\ R\ T\ S}{E^2}\right)}\right\} \qquad (11)$$

In designing a motor equipment to fulfill certain conditions, we must be able to distinguish between the part played by each of the quantities, M, v and d, in obtaining the desired result.

Example 10. A train and locomotive on the B. & O. Railroad weigh 780 tons, and have to mount a grade of 0.8 per cent at 10.7 miles per hour. The frictional resistance of the track is nine pounds per ton, reckoning at this rate both train and locomotive. The tension of the line is 625 volts. Four gearless motors are used, permanently connected in series, each having an internal resistance of 0.029 ohm.

Each motor thus has to move 195 tons on a tension of 156.2 volts. The draw-bar pull per motor for the grade is 3,490 pounds; for friction, 1,755 pounds; allowing 95 per cent mechanical efficiency, we get 5,500 pounds as the required tractive effort per motor; inserting this value together with those for E, R and S, in Equation 11, we find the value of $\frac{M}{d}$ to be 2.32, v being unity.

It appears then that whatever size of driving wheel we employ, the induction factor must be 2.32 times the diameter; and that so long as this ratio is maintained, the locomotive will haul the train up the grade at the required rate. For instance, if we take wheels four feet in diameter, the induction factor must be 111. If d is five feet six inches, M must be 153. The current at full speed is 850 amperes from Equation 8, and is unaltered by increasing or decreasing the ratio of M to d, so that we should take d as small as possible, consistent with leaving a clearance for the motor and its attachments. The actual values of M and d for the motors in use on the Baltimore line are M=144, d=62 inches.

When running at full speed each of these motors would be doing work at the rate of 158 horse-power, so that the horse-power of the locomotive would be 632. The current from the line would be 850 amperes, as obtained from Equation 8. This current will not, however, start the train on the grade. We have to find then how much current is required to do this.

If the start is to be effected in 40 seconds, since the final speed is 10.7 miles an hour, or 15.7 feet per second, the acceleration must be 0.393 foot per second. Inserting this value in Equation 10, remembering that W is 195, and $\frac{M}{d}$ is 2.32, we find the current required for acceleration to be 810 amperes, making a total current at the start of 1,660 amperes, or a force factor of 239 kilodynes. This agrees with the results obtained in starting a train of the given weight under the given conditions.

MUNICIPAL LIGHTING, BY W. WORTH BEAN, ST. JOSEPH, MO.

Municipal ownership of electric lighting plants is the more insidious that it comes dressed in the sheep's woolly garb of a philanthropist. The authors and promoters of this alluring scheme are either visionary theorists or unscrupulous politicians who hope to ingratiate themselves in the hearts of the voter and thus secure political plums.

Already cities have sold their plants, paying dearly for their experience, and others are looking for buyers, in order to unload their "white elephants." Municipal ownership is contrary to the spirit of republican institutions.

It would be just as reasonable for the city to enter any pursuit, such as farming, or as a grocer, or keep a sawmill to saw its own material for sidewalks or paving, or manufacture shoes for its citizens, or run a saloon for the profit there is in it, as for it to enter the field of lighting.

Municipal ownership is unjust to the electrical plant now in the field. The central station man has, through his industry, ingenuity and executive ability, built up a large enterprise. The city has invited him to invest thousands of dollars, not only of his own money, but also the money of its own citizens, with no immediate show of dividends, and, in some cases, barely sufficient income to pay the running expenses and interest on the bonds during a period that will amount from one-half to the whole of the average amount of time allowed for depreciation of the plant. He must either compete with the city—which, through ignorance, will furnish lights below cost—or sell out. He can not hope to dispose of a plant that has depreciated 50 or 75 per cent without great loss, therefore he is compelled to continue in business with his former heaviest consumer now his strongest competitor.

Municipal ownership is unjust to the taxpayer. The City Clerk of Hamilton, Ohio, utters a dismal wail. He says: "Hamilton, of all the cities in the United States, is the most afflicted with the municipal ownership craze, and, having had its fill on theory, is now reaching the result under adverse circumstances. We are deluded in the belief that we have cheap water, cheap gas and electric lights, but when we add to these luxuries the fact that we have so raised the rate of municipal taxation until it has become burdensome, and then compare with other cities of our size, we are not so well off as we think we are. We are taxed to pay the interest on the gasworks and the electric light plant, as well as to provide for the redemption of the bonds, and we are also taxed for the purpose of lighting the corporation, which is nothing more than a double taxation." Municipal ownership has cost the city $575,000. The taxpayer who has burned nothing but an oil lamp now helps to pay the bill.

The result, in most cases, will be less efficient service than under the competitive system. Central station men who have been in the business for a long time, and who have had years of experience, are, without doubt, the most competent to give the best service of the times. He is continually devising means for improving his service, not only in employés, but also in the latest improved machinery. On the other hand, municipalities change their officials frequently, and new men take control. Councilmen who oftentimes are not even good business men, and have no knowledge of apparatus and electrical affairs, pass on the purchasing of supplies and the competency of electricians and engineers, deposing experienced incumbents and apportioning political plums to friends of but ordinary ability.

The glowing reports from cities that are experimenting with this question are unreliable and misleading, except to the electrical profession. In some cases these statistics are honestly, though ignorantly, compiled, deceiving the taxpayer into the belief that their venture is a glorious success. The engineer's salary and the coal bill are often charged to the water department, and the water consumer helps pay the electric light bill. The Special Committee of the Municipal and Opposition Ownership, in its report to the Northwestern Electrical Association, says: "We have endeavored to investigate the results obtained in the municipal plants already established, but find that this can not be properly done, except by sending a capable representative to these plants. We have written for regular city reports, and have sent out blanks requesting answers to a number of questions asked. In the majority of instances, the expense report, as covering the cost of electric lighting, does not cover such cost, as is evidenced by finding electric light expenses charged under separate heads, and in but few instances does the city figure anything against the plant for interest, depreciation, taxes, water rent, office rent, management, fire insurance, water insurance, employers' liability insurance and general risk. It is needless to say that, including but a portion of the expense of conducting an electric light plant, they can send out reports that look very inviting to other cities that are paying a fair rate for lighting their streets and houses. The easiest way to demonstrate the fallacy of this scheme is by making a personal investigation and determining just what portion of the expenses are omitted that should be figured against the cost of the city's expenses in operating their electric light plant."

I have personally visited Niles, Kalamazoo and South Haven, Michigan, and I know that these cities are paying more for their lights than their official reports show what they cost, and yet they are considered among the list of those who are successful with municipal lighting. The city of Detroit has probably the finest equipped plant in the State of Michigan, and operated under the most advantageous circumstances, and yet she pays $100 in round numbers per lamp for 1,483 lamps, under municipal ownership, while St. Joseph and Benton Harbor, under the relentless pressure of a private corporation, only pay $90, on an average, for 62 lamps.

(To be continued.)

The Electric Appliance Company, Chicago, call particular attention to the fact that they have recently increased their stock of porcelain goods to the point where they claim they now carry the largest and best assortment of porcelain insulators, tubes and cleats in the West. Their stock includes several hundred different styles of porcelain insulators, brackets and cleats, and is certainly a most complete stock of porcelain goods.

JACKSONVILLE, TEX.—J. B. Roberts has obtained franchise for electric lighting plant from the city.

ADVANCE INFORMATION

New Electric Railways.

WICKLIFFE, OHIO — The Lake County Transit Company has been incorporated, with a capital stock of $100,000.

OAKDALE, OHIO — The Oakdale Land Company proposes building an electric street railway from its Oakdale addition so as to connect with the Oak street lines.

SARATOGA SPRINGS, N. Y.—The Saratoga Lake Railroad Company has been incorporated by Robert B. Smith, S. R. Bertron, Alfred B. Thacher, Julius F. Workamn, Hamilton Durand and others, to operate an electric railroad from Broadway to West Congress street, to Moons Corners, on the west side of Saratoga Lake. Capital stock, $150,000.

New Telephone and Telegraph Companies.

KNOX, IND.—The Starke & St. Joseph Telephone Company has been incorporated; capital, $5,000. The company will build a line from this place to South Bend.

BENTON HARBOR, MICH. — The Twin City Telephone Company has been incorporated with a capital stock of $25,000.

GOWER, MO.—The Seward Telephone Company has been incorporated by A. J. Hitt, E. A. Bunter, D. P. Cornish, and others. Capital stock, $7,000.

Electric Light and Power.

BRECKENRIDGE, MINN. — The council at this place will be petitioned to purchase an electric light plant of 600 lights, the cost not to exceed $4,500.

BRADFORD, VT. — The Bradford Electric Lighting Company has been organized with the following directors: Wm. F. Allen, president; H. E. Parker, B. S. Hooker, vice-presidents; George A. Dickey, clerk; Charles Jones, treasurer.

SANBORN, IOWA—It is reported that electric lights are to be put in.

FARIBAULT, MINN.—The Polar Star Electric Company's electric plant is being constructed.

ELY, MINN.—City Clerk may give information concerning new dynamo which is to be established at a cost of about $1,800.

BERESFORD, S. D. — City Clerk may give information concerning the electric light plant.

GAFFNEY, S. C.—The Mountain View Land Company has been incorporated by Charles M. Smith, W. H. Smith, W. C. Hennick, P. L. Cutting and R. S. Libscomb, to put in an electric plant, etc. Capital stock, $4,500.

New Manufacturing Companies.

TORONTO, CAN. — The Aylmer Electric and Manufacturing Company has been incorporated; capital, $200,000.

PORTLAND, ME.—The Continental Electric Company has been organized with Walter R. Hill, president; John G. Robinson, treasurer, for the purpose of manufacturing and dealing in electrical appliances of all kinds, etc. Capital stock, $900,000.

NEW BOOKS.

"Going Abroad?" is the catchy title of a crisp little volume by Robert Luce, manager of the well known Press Clipping Bureau, of Boston and New York. While not electrical in its nature, it has much pointed information of value to any of our electrical friends who are thinking of a foreign trip, and its perusal is commended to them before they complete their plans. The book deals with where, how and when to go, how to travel when abroad, how to live and see all the sights, and withal to practice economy in the process.

"MANUAL OF STATIC ELECTRICITY IN X-RAY AND THERAPEUTIC USES," by S. H. Monell, M. D.; 614 pp. octavo, cloth.

Dr. Monell, the founder and chief instructor of the Brooklyn Postgraduate School of Clinical Electro-Therapeutics and Roentgen Photography, has in this work taken a long stride onward in behalf of his profession. Many authors have treated of static electricity, its nature and manifestations, but we may truly say that none of them conveyed the desired practical information needed by the physician or surgeon. Useful text-books have been entirely wanting, and the physician-student has been handicapped in his search for light. Dr. Monell, however, has written a work which exactly fills the gap. He tells what to do and how to do it, and the book is what has been needed—a therapeutic treatise on static electricity. Crookes tubes, X-ray operative methods and photography are well treated and contain valuable practical information.

The book bristles with fresh and reliable facts, and generally is one which the medical library will scarcely be complete without, especially for the electro-therapeutist and the surgeon, in both hospital and private practice.

KIND WORDS.

WOULD BE LOST WITHOUT IT.

TO THE EDITOR OF ELECTRICAL REVIEW:

Inclosed please find draft for the REVIEW for one year. I think you made a great "hit" with your prompt report of the decision in the Berliner case, and would like an extra copy of the issue containing it. We would be lost without your valuable paper.

Very truly yours,

June 2. W. S. RUSH.

The contract for the erection of the new car barn for the use of the Camden, N. J., & Suburban Railway Company, which is to be erected at Newton avenue and the Camden & Atlantic Railroad, has been given out. The new building will be constructed of brick and steel, and will be 20 feet high and 100 by 300 feet. The operation on the work will be commenced at once. The company will also erect on the land adjoining the car barn carpenter, machine and repair shops. The improvements will cost nearly $50,000.

Announcement has been made of the formation of a company to build a 150-mile electric line in Nicaragua. Isham Sedgwick, of Richmond, Ind., is president; Peter Backes, Trenton, N. J., secretary, and C. H. Hall, Trenton, N. J., treasurer. The nominal capital is $100,000, and the name of the company is the Atlantic & Lake Nicaragua Railroad and Navigation Company. The company gets numerous concessions from the Nicaragua Government, among which are 250,000 acres of land. There is at present but one short line in that country.

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The Green & Bauer X-Ray Tubes.

Green & Bauer, of Hartford, Ct., manufacturers of X-ray apparatus, have brought out a special tube which they say is made at the suggestion of Dr. S. H. Monell, of Brooklyn, N. Y., and called by them the Monell static tube. They say, if a tube is made properly, the exposure may be so short that no burning of the subject's skin can result. Poor tubes require long exposures and cause burning. In constructing their tube, the above firm says a chemical is used which insures the proper vacuum and a uniformity of fluorescence, and the tubes have a penetration of from eight to twelve feet, or enough to show the bones of the adult human body and the heart action plainly at three feet from the tube, and that five to eight minutes' exposure is sufficient for photographing. A negative of the hand requires only a part of a minute.

Bicycle Chain Lubrication.

The ideal lubricant should not only lubricate the chain and sprockets, but the pivots or pins holding the links of the chain also. Lubricants made from Pure Flake Graphite are superior to any other, when properly made. An article combining a perfect lubricant and rust preventive, put up in convenient form, is something desired by every bicyclist. To all such, Dixon's *Graphitoleo* will be not only welcome, but indispensable

Dixon's *Graphitoleo* is a preparation of a very choice graphite finely pulverized, and a pure petrolatum warranted not to gum or become rancid. It is put up in collapsible tubes and is manufactured only by JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

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The B. & O. R. R. will sell excursion tickets Sunday, June 13 and 27, for train leaving New York, foot of Liberty street, 12.15 A. M. Sleeping cars attached, open for passengers at 10 P. M. Saturday night. Round trip rates as follows:

Washington	$5.00
Baltimore	4.00
Newark, Del.	3.25
Wilmington	3.00
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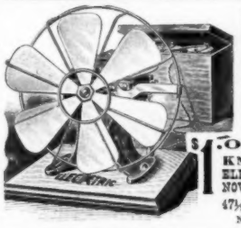

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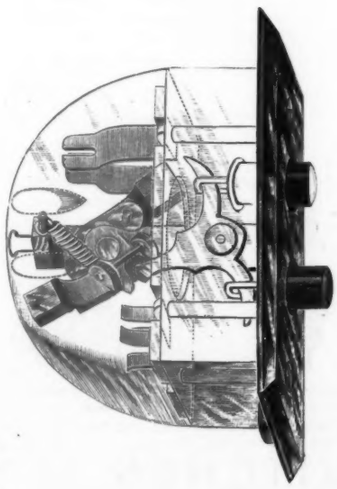

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WHAT WAS DONE BY EXHIBITORS AT THE NIAGARA FALLS CONVENTION.

DISPLAY NOT GENERAL, THOUGH A NUMBER OF COMPANIES MADE AN EXHIBIT—ARC LAMP INTERESTS WELL REPRESENTED.

In view of the fact that no hall had been engaged for exhibitions, the display of apparatus at the 1897 convention was not general, and only a few manufacturing companies attempted it.

The arc lamp interests were well represented, both in *personnel* and displays, and it was often remarked that greater progress was being made in the adaptation and improvement in this direction than in any department of electric lighting. The following were some of the gentlemen present representing the arc lamp manufacturing companies: M. L. Livingston, assistant manager of the Standard Thermometer and Electric Company, Peabody, Mass.; Louis B. Marks, M. M. E., and manager J. H. Astruck, both of the Electric Arc Light Company, New York; S. W. Wise, president of the Puritan Electric Company, New York; Bailey Whipple, of the Jandus Electric Company, Cleveland, Ohio; S. M. Hamill and Col. W. S. Rogers, of the Brush Electric Company; there were present representatives of the General Electric Company, the Fort Wayne Electric Corporation, the Walker Company, the Adams-Bagnall Electric Company, Cleveland; the Manhattan General Construction Company, New York.

Mr. G. A. MacIntire, of the International Arc Lamp Company, made the first exhibition of the new MacIntire arc lamps, which created much interest as being radically new in the lighting field.

The exhibition of instantaneous switches and "Hope" apparatus, made by the Hope Electric Appliance Company, of Providence, R. I., attracted a large share of attention. The practical ideas involved in the construction of these devices appealed strongly to central station men, and it was said that the immediate sales of the Hope Electric Appliance Company at the convention were large. The company was represented by Messrs. Robert Fessenden and John I. Drake.

Mr. George A. Thompson, representing the Forest City Electric Company, of Cleveland, was present, and in charge of an interesting line of the commutator bars and protected rail bonds made by that company.

The voltage regulators for direct and alternating currents recently perfected by the Belknap Motor Company, of Portland, Me., were shown by the Brewster Engineering Company, of New York. This company also showed the junction boxes and circuit-breakers made by the Bossert Electric Construction Company, of Utica. Mr. Bossert, of the Bossert company, was also present in person.

General Manager Isaacs, of the K. McLennan & Company, Chicago, was one of the busiest men of the convention. The company are the manufacturers of Gale's commutator compound, and as Mr. Isaacs, who is a lawyer by profession and a large stockholder in the McLennan company, says, "two thirds of the central stations of America are our patrons, and we are now after the other third."

A number of the Puritan alternating arc lamps were in operation on the wide veranda of the International Hotel. This is one of the modern 100-hour lamps which has been so widely adopted in the past year. Mr. S. W. Wise, president of the Puritan Electric Company, New York, was a visitor.

The Standard Paint Company was well represented by Messrs. Howard, of the Chicago office, and Benedict, from the home office, New York. The insulating compounds and tapes made by this company are in almost universal use in the electrical industry. Many expressions of regret were heard because of the absence of Mr. Frank S. DeRonde, the general sales agent, who was at Old Point Comfort with the meeting of the master car builders. The souvenir given away by the Standard Paint Company, a dainty memorandum book covered with white kid, was one of the much-sought mementoes.

The American Electric Heating Corporation showed a line of circuit-breakers and current-controlling devices in the main corridor of the International. Mr. Jas. I. Ayer, general manager, was one of the prominent gentlemen present whose career in the electrical industry has been a long and active one.

Although the Bernstein Electric Company, Boston, has been very active during the last year in putting before the trade new electric lighting specialties, and the improved lines of the "Bernstein" multiple series and railway lamps, they made no exhibit beyond a supply of catalogues and descriptive matter. Mr. James Bradley, the general manager of the company, remained at the International during the three days.

A number of the "Elden" circuit-breakers, an apparatus which breaks both the exciter and main circuit simultaneously, when short-circuit occurs, were on exhibition in the main corridor of the International, by L. A. Chase & Company, of Boston. This company was well represented by the entertaining Mr. Conduit.

Mr. H. P. Moore, superintendent of the Shawmut Fuse Wire Company, of Boston, was a guest at the International Hotel.

Mr. H. McL. Harding was present in person for the Walker company, and Mr. J. Holt Gates, of the same company, also spent the last two days with the convention.

Mr. Elmer P. Morris occupied a suite of rooms in the Cataract House, which was the Mecca for numerous weary conventionists both day and night. Mr. Morris is New York agent for the following houses: Keystone Electric Instrument Company, Notwotny Arc Lamp Company, of Cincinnati; Simond Manufacturing Company, Electric Railway Equipment Company, Cincinnati.

The Keystone Electrical Instrument Company, of Philadelphia, have, within the past month, developed a number of excellent types of new electrical instruments, such as a portable voltmeter, polarity indicator, and also made improvements in the standard types of the "Keystone" switchboard measuring instruments. Mr. R. F. Stevens, president of the company, under whose personal supervision this work has been done, was present at the convention.

The Fort Wayne Electric Corporation made no attempt at a general display beyond showing the new "Duncan" integrating lamp-hour, ampere-hour and watt-hour meters. These gentlemen, all of the Fort Wayne Electric Corporation, were at Niagara Falls during the meeting: Messrs. Thos. Cooper, Pittsburgh; John C. Latt, New York; C. H. Philbrook, Buffalo; John H. Phinney, Rochester; Chas. S. Knight, vice-president and general manager; Jas. J. Wood, chief engineer; Thomas Duncan, Frank A. Wunder.

The Cutter Electric and Manufacturing Company, of Philadelphia, exhibited a line of the "Cutter" circuit-breakers and current-controlling devices in the Cataract Hotel. Messrs. Henry B. Cutter, president of the company, and H. B. Kirkland, the New York agent for the house, were registered at the Cataract Hotel. Mr. Kirkland is also New York agent for the American Circular Loom Company, of Boston; Mr. Brooks, of the American Circular Loom Company, received friends of the company at the Cataract.

Among the exhibits of electrical apparatus, the display made by the Westinghouse Electric and Manufacturing Company attracted great attention. It was generally commented upon by the guests and delegates that the exhibit made by the Westinghouse company was not only very complete, but was full of interesting features. Several lines of apparatus were in view and in actual operation. Among them was a 15-horse-power, 500-volt direct-connected motor driving a seven and one-half-horse-power, 125-volt direct-connected generator, and a 10-horse-power, 100-volt alternating-current, direct-connected two-phase generator. From the alternating-current circuits was operated a one-horse-power, two-phase induction motor, constant potential arc lamps, induction motors, etc. The circuits were all supplied with the Shallenburger-Watt motors, showing their operation to great advantage. A full line of converters were shown, from the smallest size up to a 25 kilowatt converter in oil. The new type of panel switchboards was on exhibition for both alternating current and direct-connected generators. A full line of lightning arresters was shown, both for arc and incandescent high-potential circuits. The Sawyer-Man Lamp Company, of Allegheny, Pa., had a very attractive exhibit in connection with the Westinghouse display, consisting of lamps of various candle-power and voltage. The principal feature of this exhibit was the display of 220-volt lamps. The very long filament necessary for a thoroughly satisfactory lamp of this high voltage is rendered perfectly stable by means of the three points supported for the loop.

The exhibitions of the Westinghouse Electrical Manufacturing Company and the Sawyer-Man Electric Company were situated in the south-end corner upon the veranda of the International Hotel, where a large parlor and a private office had been engaged. The parlor was very tastefully decorated, in the front of the windows as well as in the interior—numbers of incandescent lamps and three constant-potential arc lamps illuminated the exhibits at night. The exhibits were in charge of Mr. W. K. Dunlap and Mr. M. McLaren, of Pittsburgh, Pa. The Westinghouse company were represented at the convention by the following gentlemen: C. F. Scott, Pittsburgh; B. G. Lamme, Pittsburgh; C. A. Bragg, Philadelphia; T. B. F. Paim, Boston; F. S. Smith, Pittsburgh; Maurice Coster, Chicago; Paul T. Brady, Syracuse; T. C. Frenyear, Buffalo; F. N. Waterman, New York; W. K. Archbold, New York; H. P. Davis, Pittsburgh; Clarence A. Ross, Buffalo; E. H. Heinrichs, Pittsburgh; R. S. Feicht, Philadelphia; Arthur Hartwell, Pittsburgh; C. S. Skinner, Pittsburgh; C. F. Medbury, Chicago.

The exhibit of the General Electric Company at Niagara Falls was small, but dealt with such apparatus as most nearly concerns managers of lighting stations, i. e., elements of improvement in their equipment and means for more accurately measuring and metering their output. Considerable attention was attracted by the new Prepayment meter, presently to be placed upon the market. In combination with the meter is a coin receiving device by means of which a consumer is enabled to pay for his light beforehand, know how much he has paid, and receive only what he has paid for. The field for this type of meter promises to be very large among consumers able only to use electricity in moderate quantities. The operation of this instrument was very carefully explained to the delegates by Mr. Caryl D. Haskins. The arc lighting department was represented by samples of the single solenoid lamp, the long burning lamp for 220-volt circuits, the focusing lamp for series arc circuits, the inclosed long burning lamp for 110-volt circuits, and that for alternating-current circuits. The simplicity of the mechanism of the latter lamp, and its perfect operation created a marked impression upon the delegates. The type H transformer, the most recent type developed by the General Electric Company, also occupied a prominent position in the room. An X-ray set completed the exhibit of the General Electric Company. This was shown during the afternoons and evenings, and while in operation attracted large crowds to the rooms. On Tuesday all the foreign delegates to the Postal Congress, under the guidance of General Batchelor, witnessed a special exhibition given for their benefit by Mr. F. M. Kimball and Mr. Haskins. The company distributed a tasteful souvenir book, illustrative of Niagara Falls and the work which it has done in connection with the utilization of their power. It also presented the delegates with a "planigraph" or

(*Continued on next page.*)

The Replogle Governor Works, of Akron, Ohio, have installed two of their new relay returning governors at Wilmington, Del., one regulating the water-wheels in a cotton mill and the other those in the electric light plant. The governor is purely mechanical in its operation and shows marked efficiency. The makers are completing governors of similar type for two electric railway and power plants in Canada, two for a power-transmission plant in the South, and two for the far West.

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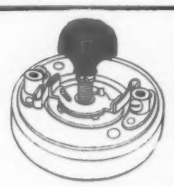

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H. T. PAISTE CO.
CHICAGO PHILADELPHIA

WHAT WAS DONE BY EXHIBITORS.

(*Continued from Preceding Page.*)

wire calculator. This was highly appreciated. For the ladies, the company prepared a handsome little silver-mounted souvenir. The parlors of the General Electric Company were decorated with framed diplomas, and with some excellent enlarged photographs of its important installations and apparatus. Its representation included the following gentlemen: Prof. Elihu Thomson, S. Dana Greene, W. L. R. Greene, J. R. Lovejoy, H. C. Wirt, J. M. Andrews, J. W. Kirkland, G. DeB. Greene, J. H. L. Hilman, Schenectady, N. Y.; M. K. Eyre, A. D. Sage, Harrison, N. J.; Chas. W. Davis, A. R. Bush, F. M. Kimball, Caryl D. Haskins, S. B. Paine, Boston, Mass.; W. D. A. Ryan, Lynn, Mass.; C. E. Estabrook, I. McGhie, New York, N. Y.; N. J. Buddy, D. R. Ballen, Philadelphia, Pa.; J. C. Calish, Pittsburgh, Pa.; L. H. Cooper, E. K. Gillette, Cincinnati, Ohio; H. H. Crowell, Syracuse, N. Y.; T. W. Dixon, Columbus, Ohio; J. P. Judge, Baltimore, Md.; H. M. Ray. C. P. Steinmetz, San Francisco, Cal.

The Standard Underground Cable Company, of Pittsburgh, New York and Chicago, was represented by Geo. L. Wiley, eastern manager, and T. E. Hughes, manager wire department, both of New York. The exhibit in parlor G showed samples of electric light and power cables for aerial and underground service, with their well known fibre, rubber, and paper insulations. They distributed a large number of their Ohm's law souvenirs.

The H. W. Johns Manufacturing Company had an exhibit in a corner of the lobby of the International Hotel of a few of their electrical specialties. Their electro-thermo heating pad and H. W. J. car heaters, heated by electricity from the local circuits, attracted much attention. Among their novelties were the giant arc lamp hanger, very strong and highly insulated with sheet mica, and the toggle clamp feed wire insulator, which automatically grasps the wire, and requires no tie wires. Numerous samples of vulcabeston and moulded mica insulating parts for electrical devices comprised the rest of their instructive display. Mr. W. F. D. Crane was in attendance and was greeted by a host of friends.

The Phœnix Glass Company was ably and entertainingly represented by Mr. E. H. Peck.

There will be a number of additional notes relating to this convention in the ELECTRICAL REVIEW next week. Look out for them!

The Standard Thermometer and Electric Company, of Peabody, Mass., was well represented by Mr. M. L. Livingston, assistant general manager of the company. Mr. Livingston has been identified with the management of the Standard company only a little more than a year, but his success in that time with the Upton arc lamps has been decided. This company has recently perfected the "Midget" inclosed arc lamp and are introducing it in connection with the standard designs of the "Upton" lamps which are so favorably known.

Mr. A. D. Newton, of the Eddy Electric and Manufacturing Company, Windsor, Ct., and Mr. A. H. Pease, of the Hart & Hegeman Manufacturing Company, Hartford, were two prominent gentlemen from the old "Nutmeg" State representing large interests.

Messrs. W. C. Bryant, president, E. M. Scribner and Edward R. Grier, of the Bryant Electric Company, Bridgeport, Ct., were all at the International Hotel during the three days' session.

Mr. S. M. Hamill, general manager of the Brush Electric Company, was a constant attendant in the convention sessions during the three days it met.

Mr. A. L. Daniels, representing the H. B. Camp Company, Aultman, Ohio, was prominent among the conduit men.

Mr. J. P. McQuaide, the handsome and alert representative of the National Conduit and Cable Company, renewed acquaintance with a large circle of friends and was one of the genuinely busy men at the convention.

The souvenir most sought for, and perhaps of greatest intrinsic value, was the sterling-silver and gold-lined match-box with the single word "Pioneer" prettily engraved on the side, given by the Electric Arc Light Company, of New York.

THE ATTENDANCE.

(*Continued from Page 290.*)

YOUNGSTOWN, OHIO.
B. P. Holmes, E. A. Bell.

SANDUSKY, OHIO.
Emil G. Shuriat.

ST. LOUIS, MO.
Ferd. G. Schwattmann, H. A. Wagner,
A. C. Garrison, J. H. Rhotchamel.

ONEONTA, N. Y.
G A. Lane.

DAYTON, OHIO.
A. A. Thresher.

STOCKTON, CAL.
Frank P. Adams.

HARTFORD, CT.
A. H. Pease, C. L. Tolles.
A. D. Newton,

GENEVA, OHIO.
A. F. Dickinson.

BRIDGEPORT, CT.
L. W. Eaton, W. C. Bryant,
J. B. Hubbell, E. M. Scribner.

FREDONIA, N. Y.
M. M. Fenner.

OIL CITY, PA.
W. H. Cooper.

CHILLICOTHE, OHIO.
C. H. Juneman.

EVANSVILLE, IND.
C. P. White.

ALTOONA, PA.
J. P. Graham.

JOHNSTOWN, PA.
J. W. Reeves.

BROCKPORT, N. Y.
W. H. Roberts, C. A. Roberts.

LEROY, N. Y.
S. M. Wheeler.

SWAMPSCOTT, MASS.
Elihu Thompson.

ST. CATHARINES, ONT.
Miss Lena Powell, E. E. Cary.
Geo. A. Powell,

NORTH ADAMS, MASS.
Frank Richardson.

BRISTOL, PA.
Chas. E. Scott.

SCRANTON, PA.
G. G. Sturges.

OLEAN, N. Y.
George Forbes.

MONROE, MICH.
G. P. Hurd.

NEW ORLEANS.
Wm. Von Phul.

SPRINGFIELD, OHIO.
Jno. H. Miller.

ELKHART, IND.
John C. Bass.

ELMIRA, N. Y.
S. N. Blake.

WALTHAM, MASS.
Thos. P. Smith.

QUEBEC, CANADA.
T. A. Badger, Jr.

HORNELLSVILLE, N. Y.
L. T. Mason.

HANOVER, PA.
J. W. Mumper.

THE LADIES.

The convention was well attended by ladies, among whom were:

New York: Mrs. W. J. Johnston, Mrs. H. M. Swetland, Mrs. W. T. Hunt, Mrs. C. O. Baker, Jr., Mrs. H. B. Jagoe, Mrs S. L. Coles, Miss H. Douglass, Miss H. Billings, Mrs. J. Wetzler.
Philadelphia: Mrs. H. B. Cutter, Mrs. H. Clay, Miss Savilla E. Clay, Miss Mabel Clay.
Chicago: Mrs M. J. Isaacs, Mrs. W. A. Kreidler.
Boston: Miss Mae E. Mason, Mrs. C. B. Price, Mrs. Chas. B. Davis
Waterbury, Ct: Mrs. A. M. Young, Miss Lucy C. Young, Miss Helen Frisbie.
Camden, N. J.: Miss Elizabeth W. Armstrong, Miss Carrie W. Morgan.
Woodbury, N. J.: Miss Mary Whitall.
Newark: Mrs. Henry Hayes.
Waltham, Mass.: Mrs. Thomas P. Smith.
Mt. Holly, N. J.: Mrs. Joseph H. Gaskill.
Cleveland: Mrs. R. C. Foster.
Rochester: Mrs. George A. Redman.
Syracuse: Mrs. T. G. Gorke.
Schenectady: Mrs. J. R. Lovejoy.
St. Catherine, Ont.: Miss Lena Powell.
Warren, Ohio: Miss Charlotta Packard

Litigation Between Arc Lamp Companies.

A notice was distributed at the Niagara Falls convention, signed by the Manhattan General Construction Company, Mr. S. Marsh Young, president, New York, containing the following:

"We have been informed that a notice has been generally distributed by the Jandus Electric Company to the effect that their contract with this company as exclusive selling agents has been terminated, and that they will not hereafter supply their lamps through this company.

"I beg to inform you that the action of the Jandus Electric Company is unwarranted and illegal. We have taken immediate steps in the courts to compel the Jandus Electric Company to recede from its position and to continue to supply us with lamps as heretofore, under the contract which we have with that company, which has continued for two years without interruption and which has still five years to run, at our option."

The Lombard Water Wheel at Niagara Falls—A Deserved Mention.

TO THE EDITOR OF ELECTRICAL REVIEW:

I note on page 269 of your issue of the 9th instant, in an article entitled "Electricity at Niagara Falls," that you state that no governor is used in connection with the turbines driving the Westinghouse generators. No allusion is made to the fact that the entire portion of the plant which is devoted to driving electric railway generators is controlled by a Type G Lombard governor. Considering the very high head and the large and sudden load variations which occur on the Gorge road, and on the Lewiston & Youngstown road, this is considered one of the most difficult pieces of turbine governing in the world. The speed regulation produced by this governor is within two per cent under ordinary working conditions of the roads. On March 17, a piece of the iron frame of the new bridge fell across the line, producing a dead short circuit and consequent maximum load, followed by an open circuit, the entire load being instantly removed *while the water-wheel gates were wide open*. Under these most difficult of all conditions the governor maintained a speed so constant that the recording voltmeter showed a practically straight line. This voltmeter card has been published.

Considering that these turbines were working under the highest head which is utilized in any of the Niagara Falls plants, it would seem that a fair description of this plant should have contained an allusion to the fact that the turbines which operate on variable load are controlled by a Lombard governor.

Respectfully yours,
ALLAN V. GARRATT, chief engineer.
Boston, June 10.

New Catalogue of "Hart" Switches.

A new catalogue of the "Hart" Switches has just come from the press, illustrative of the new and regular forms of this standard line of electrical goods. The booklet is of general interest to all electric lighting men, as the Hart & Hegeman Manufacturing Company, of Hartford, the makers of these switches, have aimed to give full information and diagrams, as to wire connections for the various types.

WANTED FOR CASH

One 200 to 250 horse-power, compound, high-speed, automatic engine; one 150 horse-power simple, do. Must be in good condition. Also air and circulating pump of 600 horse-power capacity. Address, with full particulars and where can be seen,
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Position by a young man (24) at some branch of electrical work.
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Care ELECTRICAL REVIEW,
Times Building, New York.

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REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works, Olympia, Oregon.

EDW. S. DUVALL, Solicitor of Patents. Loan and Trust Bldg., WASHINGTON, D. C.

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the difference BETWEEN OUR BATTERY COPPERS and others is in the QUALITY. **There is little other difference.** The high QUALITY of our product is caused by combining **Pure Copper** and **the Best Leading Wire** with the most **careful workmanship.** THE PRICE depends upon the size of the order: THE BIGGER THE ORDER, THE SMALLER THE PRICE.

THE McDERMID MANUFACTURING CO., CHICAGO.

The Upton Inclosed Arc Lamp.

In comparing the efficiency of inclosed arc lamps with open arc lamps for service on street lighting and commercial circuits, the question of their respective candle-powers is naturally an important consideration. While it is true that, with an inclosed arc, the candle-power is lessened somewhat, actual experience has proved that this loss is more than counterbalanced by the gain in steadiness of light, equality of diffusion and absence of shadow in the use of an inclosed arc; especially in the high-tension series lamp has this fact been developed.

The open arc series lamp in feeding, loses efficiency of light, and the feeding process takes place every five to ten minutes. The inclosed arc lamp feeds only once every four or five hours, and the rise and drop in voltage are so slight and gradual as not to be noticeable.

The Upton Midget inclosed arc series lamp, manufactured by the Standard Thermometer and Electric Company, of Peabody, Mass., embodies in its mechanism all that is best and simple in the recent development of arc lamp construction. It is designed so that it can be easily adjusted to take from 65 to 80 volts as may be desired and burn on from four and one-half to seven ampere circuits without readjustment. Each lamp is provided with a switch, and an automatic cutout which is positive in its action. These lamps are now in use on street lighting and commercial circuits, and the manufacturers claim to have flattering reports of their successful operation. Full information and circulars will be furnished by them on application.

The Snow Steam Pump Works, of Buffalo, N. Y., have issued a new and handsome illustrated catalogue comprising most of the styles of pumping machinery for all purposes built by them. Every engineer should have one of the new catalogues for reference.

Observation Sleeping Cars on B. & O.

Commencing Sunday, June 13, the B. & O. R. R. will place in service, between Baltimore and Chicago, *Pullman Observation Sleeping Cars*. The cars have a saloon parlor in the rear, furnished with easy armchairs, upholstered revolving chairs and sofas. This will enable passengers to view with better advantage the scenic wonders that have made the B. & O. famous.

J. M. SCHRYVER,
Gen. Pass. Agent.

At Farmington, Mo., a right of way and franchise has been secured by W. E. Bailey to build and operate an electric street railway from there to the railway station, a distance of three miles. This will be standard guage track, and will haul the freight cars through to its terminal. A company will soon be organized to build the road and operate it.

At a special meeting at Springfield, Vt., the town voted to give its $30,000 worth of stock in the uncompleted Springfield electric railway, connecting Springfield with Charlestown, N. H., to any responsible party who will complete the road and put it in running condition. Of the $120,000 capital stock only $54,000 has been paid in. The road has been at a standstill since last December. Fully $100,000 is needed to put it in operation. It is thought a Boston syndicate will purchase the road, putting in $70,000 and local parties the remaining $30,000.

CLEARANCE SALE

— OF —

SHELF-WORN BOOKS

	List.	Net.
Atkinson. "Elements of Static Electricity"	$1 50	$0 50
Angell. "Elements of Magnetism and Electricity"	1 00	0 60
Bottone. "Electric Bells and All About Them"	0 50	0 40
Dolbear. "The Telephone, with Directions for Making"	0 50	0 30
Cumming. "Electricity Treated Experimentally"	1 50	0 50
Gordon. "School Electricity"	3 00	0 75
Fiske. "Electricity and Electrical Engineering"	2 50	1 00
Haskins. "Transformers: Theory, Practice and Application"	1 25	0 75
Houston. "Electrical Dictionary," old ——		1 00
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2	1	"	500 "	Ketchum. New.
1	1¾	"	220 "	C. & C.
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1	30 "	2,000	"	"
2	30 "	1,200	"	"
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